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November 1998

U.S. Department of Energy
Idaho Operations Office

Comprehensive Remedial Investigation and Feasibility Study Supplement for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory

INEEL
IDAHO NATIONAL ENGINEERING & ENVIRONMENTAL LABORATORY

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Douglass J. Kuhns

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D. J. Kuhns
WAG 1 Manager

Date

EXECUTIVE SUMMARY

The Idaho National Engineering and Environmental Laboratory (INEEL) Test Area North (TAN) is designated as Waste Area Group (WAG) 1 in the Federal Facility Agreement/Consent Order (FFA/CO) negotiated among the U.S. Environmental Protection Agency (EPA), the State of Idaho Department of Health and Welfare (IDHW), and the U.S. Department of Energy, Idaho Operations Office (DOE-ID) (collectively, the Agencies). The FFA/CO describes the plans for conducting a Remedial Investigation/Feasibility Study (RI/FS) to evaluate contaminant releases and associated potential risks to human health and the environment. Operable Unit (OU) 1-10 was defined in the FFA/CO as the WAG 1 Comprehensive RI/FS. The 94 contaminant-release sites identified with WAG 1 have been grouped into 10 OUs. These were categorized as remedial investigation, interim action, Track 1, Track 2, no action, and new and unevaluated sites. The WAG 1 Comprehensive RI was conducted to determine or define the nature and extent of contamination associated with WAG 1 sites and to determine the potential and future cumulative and comprehensive risk to human health and the environment posed by this contamination. Based on the results of the RI, nine sites were determined to pose potentially unacceptable risks to human health and/or the environment. The Comprehensive RI/FS was conducted to define and evaluate potential remedial action remedies that would have the ability to reduce or eliminate these unacceptable risks. The results of the Comprehensive RI/FS were presented in the *Comprehensive Remedial Investigation/Feasibility Study for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory* (DOE/ID-10557, November 1997).

Subsequent to the completion of the Comprehensive RI/FS, the Agencies prepared and submitted for public review a Proposed Plan (February 1998) that identified and provided concurrence on preferred remedial action alternatives. The remedies were based on the results of the detailed evaluation of alternatives presented in the Comprehensive RI/FS. Based on comments received, it was clear that several technical issues required resolution. This FS Supplement addresses these technical issues, reevaluates potential remedies, and develops additional alternatives that would be protective of human health and the environment, and provides the Agencies with sufficient information to make a final decision on a preferred alternative for each of the sites. Based on the results of this FS Supplement, the Proposed Plan will be revised and resubmitted to the public for review. Ultimately, this process will lead to a Record of Decision and eventual implementation of the selected remedies.

Sites evaluated in this FS Supplement include the following, located at the TAN Technical Support Facility (TSF) and Water Reactor Research Test Facility (WRRTF):

- TSF-03 and WRRTF-01 Burn Pits
- TSF-26 PM-2A Tanks
- WRRTF-13 Fuel Leak.

For each of these sites, additional remedies have been developed that represent either new technologies not previously evaluated, modifications to previously evaluated technologies, or reevaluations of existing technologies based on new or additional information. Because this document includes only new or additional information, it is not considered a stand-alone document and should only be used in conjunction with the Comprehensive RI/FS (November 1997). References to the Comprehensive RI/FS have been included where appropriate.

For the burn pits (TSF-03 and WRRTF-01), previous investigations did not provide a broad range of contaminant data due to earlier determinations of potential contaminant releases based on process knowledge. Questions were raised concerning the previously selected preferred alternative (Limited Action) due to uncertainties in the nature and extent of contamination. As a result, Alternative 3 has been modified to include additional waste characterization sampling, excavation, treatment (if required), and disposal (Alternative 3b). A comparative analysis has been completed that evaluates Alternative 3b against the alternatives previously developed.

For the PM-2A tanks (TSF-26), hazardous waste constituents in the tank sludge may exceed levels allowable for Resource Conservation and Recovery Act (RCRA) waste disposal criteria. The previously identified preferred alternative of in situ stabilization (Alternative 4) would be difficult and costly to implement due to the physical nature and incomplete characterization of the waste. The long-term monitoring requirement would also be costly. As a result, Alternative 3 was modified to include an additional option (Alternative 3d) for waste removal and treatment and tank closure. A comparative analysis has been performed that evaluates the new Alternative 3d against the alternatives previously developed.

Among the alternatives evaluated for the petroleum-contaminated soils at WRRTF-13 (the Fuel Leak) were limited action, and excavation and land farming. Comments were received that indicated that in situ biodegradation techniques also should have been evaluated for this site. As a result, Alternative 5, biodegradation through bioventing, was developed and evaluated as an additional remedy for the treatment of WRRTF-13 soils. A comparison with previously evaluated alternatives was conducted.

From the results presented in this FS Supplement, the Agencies will evaluate whether their previously identified preferred alternative selections remain valid. The Proposed Plan scheduled for release in November 1998 will include all revisions resulting from public, agency, and internal reviews and any changes warranted as a result of this FS Supplement.

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FIGURES

TABLES

ACRONYMS

ALARA	as low as reasonably achievable
ARARs	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	contaminants of concern
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy, Idaho Operations Office
EPA	U.S. Environmental Protection Agency
FS	feasibility study
FFA/CO	Federal Facility Agreement and Consent Order
FY	fiscal year
IDHW	Idaho Department of Health and Welfare
INEEL	Idaho National Engineering and Environmental Laboratory
LDR	land disposal restriction
NA	not applicable
NPV	net present value
OU	operable unit
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PRG	preliminary remediation goal
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
TAN	Test Area North
TBC	to be considered criteria, advisories, or guidance

TBD	to be determined
TSCA	Toxic Substances Control Act
TSF	Technical Support Facility
WAG	waste area group
WRRTF	Water Reactor Research Test Facility

Comprehensive Remedial Investigation and Feasibility Study Supplement for Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory

1. INTRODUCTION

Between the 1950s and 1980s, research activities at the Idaho National Engineering and Environmental Laboratory (INEEL) Test Area North (TAN) left contaminants that pose risks to human health and the environment. A comprehensive Remedial Investigation and Feasibility Study (RI/FS) was initiated in 1995 to determine the nature and extent of the contamination at TAN. The Comprehensive RI/FS was conducted in accordance with the Federal Facilities Agreement and Consent Order (FFA/CO) among the U.S. Department of Energy, Idaho Operations Office, (DOE-ID), the Environmental Protection Agency (EPA), and the State of Idaho, Department of Health and Welfare (IDHW) (the Agencies)

Test Area North, which is designated as Waste Area Group (WAG) 1, has been divided into 10 Operable Units (OUs) for management purposes. OU 1-10 is defined in the FFA/CO as the WAG 1 Comprehensive RI/FS. The Comprehensive RI/FS effort and results are documented in the *Comprehensive Remedial Investigation/Feasibility Study for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory* (the Comprehensive RI/FS) (DOE/ID-10557, November 1997).

Following completion of the Comprehensive RI/FS, a Proposed Plan was issued in February 1998 summarizing the Comprehensive RI/FS and presenting the remedial action alternatives preferred by the Agencies. Comments received from public, regulatory, and internal reviewers identified several technical issues with regard to some of the alternatives.

This Feasibility Study (FS) Supplement presents the additional information compiled in response to the issues identified by reviewers. The alternatives presented in this document represent either new technologies not evaluated in the Comprehensive RI/FS, modifications to previously evaluated technologies, or reevaluations of existing technologies based on new or additional information. The alternatives presented in this supplement were evaluated against the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) criteria and specific remedial action objectives.

This FS Supplement, like the Comprehensive RI/FS, was prepared in accordance with the requirements of the National Oil and Hazardous Substances Contingency Plan, the Code of Federal Regulations (Chapter 40, Section 300), and CERCLA guidance. Assumptions used in preparing this Supplement were the same as those used to prepare the Comprehensive RI/FS except where noted in this document (Section 9.2 of the Comprehensive RI/FS discusses the assumptions used).

For the TAN sites where alternatives were modified or added, this document summarizes the Comprehensive RI/FS findings, discusses the technical issues that were identified, and provides a detailed evaluation of the additional alternatives. It is not intended to be a stand-alone document but, rather, to be used in conjunction with the Comprehensive RI/FS. References to the Comprehensive RI/FS have been included where appropriate.

Alternatives were modified or added for the following sites at the TAN Technical Support Facility (TSF) and Water Reactor Research Test Facility (WRRTF):

- TSF 26 PM-2A Tanks
- TSF-03 and WRRTF-01 Burn Pits
- WRRTF-13 Fuel Leak.

Section 2 of this Supplement is an overview of the background and issues surrounding the development of these additional alternatives. Revisions to the remedial action objectives (RAOs) are summarized in Section 3. Section 4 presents the alternatives evaluated in this Supplement. Section 5 provides the results of the detailed analysis of these alternatives against the CERCLA evaluation criteria. Finally, Section 6 compares the new alternatives against the previously evaluated alternatives.

2. BACKGROUND AND ISSUES

During the public review of the February 1998 *Proposed Plan for Waste Area Group 1—Test Area North, Idaho National Engineering and Environmental Laboratory,* technical issues were raised concerning the preferred alternatives selected by the Agencies. Before a revised Proposed Plan was issued to the public, the alternatives were reevaluated to address these issues.

In general, the unresolved issues, which only apply to certain OU 1-10 sites, relate to three stages of the RI/FS process:

1. ***Characterization of the nature and extent of contamination present in an area.*** For four sites (TSF-03 and WRRTF-01, the Burn Pits; TSF-26, the PM-2A Tanks; and WRRTF-13, the Fuel Leak), incomplete determination of contamination may have occurred. If so, it may have resulted in (a) incomplete risk assessment; (b) too few or inefficient alternatives being developed; (c) in complete evaluation of alternatives and selection of preferred alternative; or all three.

2. ***Development of alternatives.*** For the same four sites, additional remediation alternatives may exist that were not included in the list of those considered. For one site (TSF-26, the PM-2A Tanks), the addition is due to the identification and evaluation of new technology since the original study was completed.

3. ***Evaluation of alternatives against CERCLA criteria.*** Specifically, both of the threshold criteria and two of the five balancing criteria may not have been sufficiently considered for one or more alternatives at these four sites. The first threshold criterion, overall protectiveness of human health and the environment, may not be met if characterization of contaminants and subsequent assessment and evaluation were incomplete. The second, compliance with ARARs, may not be met if waivers required are not explicitly identified. Some alternatives may not be completely evaluated for the balancing criterion of implementability, if an alternative has not been demonstrated to work on a certain contaminant, or at a site of a certain size. Finally, evaluation of cost effectiveness may be incomplete if cost data were insufficient or incorrect; for example, if the cost of long-term monitoring was not included.

2.1 TSF-26 PM-2A Tanks

The previously proposed preferred alternative of in situ stabilization would be difficult to implement, given the physical nature of the waste and its incomplete characterization. Since the waste characterization did not include Resource Conservation and Recovery Act (RCRA) analysis, a RCRA waste determination cannot be made. Hence, treatment requirements cannot be accurately determined. The previously preferred alternative would also be costly, because in situ stabilization would require long-term monitoring at the site.

2.2 TSF-03 and WRRTF-01 Burn Pits

At the burn pit sites, insufficient data are available to adequately determine potential risks to human health and the environment. An analysis of the existing data indicates that the lead concentrations exceed the preliminary remediation goal (PRG) of 400 ppm specified in the Comprehensive RI/FS. In addition, the existing soil cover ranges from less than 6 inches in some areas to approximately 9 feet in other areas. Finally, sampling and analysis was based on "process knowledge," which focused the analytical suite on a limited number of chemicals. Recent information on past disposal practices and experience at other INEEL remediation sites indicates the previous analyses may have been too limited to accurately determine contamination and subsequent risk at these burn pits. Due to the high concentrations of lead, limited soil cover in portions of the sites, and lack of data on other potential contaminants, the previously preferred limited action alternative may not be the best choice to ensure the goal for overall protectiveness is met.

2.3 WRRTF-13 Fuel Leak

The quantity and type of contamination has not been fully determined. As a result, there is uncertainty in estimated risks associated with the WRRTF-13 site. In addition, due to the need for long-term monitoring, estimated costs associated with the previously selected limited action alternative appear to be higher than estimates for soil removal and treatment at the Central Facilities Area land farm. Also, in situ biodegradation was not evaluated in the Comprehensive RI/FS as a potential alternative for the petroleum-contaminated soils at this site.

3. REVISIONS TO THE REMEDIAL ACTION OBJECTIVES

The RAOs presented in the Comprehensive RI/FS for OU 1-10 were defined through discussions among the Agencies. These RAOs provided the basis for the development of the general response actions and PRGs that will satisfy the objectives of protecting human health and the environment and ensuring compliance with ARARs.

The RAOs developed in the Comprehensive RI/FS for OU 1-10 are:

For the soil pathway:

- Reduce risk from external radiation exposure from Cs-137 and Ra-226 in soil to a total excess cancer risk of less than 10^{-4} for the 100-year future hypothetical resident.
- Prevent direct exposure to lead in soils at concentrations in excess of 400 mg/kg.
- Prevent uptake of mercury in soil that would result in a hazard quotient greater than 1 for the homegrown produce ingestion exposure route for the 100-year future hypothetical resident.[a]

For the V-tanks and PM-2A tanks:

- Prevent any release of tank content(s) contaminants of concern (COCs) to the environment.

For co-located facilities:

- Maintain the current institutional control of the co-located facilities until decontamination and decommissioning is complete.
- Prevent risk at the co-located facilities from exceeding 2E-04 total excess cancer risk from all exposure routes if releases are discovered or known releases are accessed.
- Prevent noncarcinogenic hazards at the co-located facilities from exceeding a hazard quotient of 1 from all exposure routes if releases are discovered or known releases are accessed.

For the soil pathway, the RAO specified reduction of risk from exposure to Ra-226. Further evaluation of the existing data since completion of the Comprehensive RI/FS has shown that Ra-226 is not a COC at the TSF-07 Disposal Pond, as originally reported in *TAN TSF-07 Pond Radium-226 Concentrations and Corrections* [ER-WAG1-108 (INEEL/EXT-98-00505)]. As a result, the RAO has been revised as follows:

- Reduce risk from external radiation exposure from Cs-137 in soil to a total excess cancer risk of less than 10^{-4} for the 100-year hypothetical future resident and the 100-year future worker.

The PRGs developed in the Comprehensive RI/FS were not re-evaluated in this FS Supplement since it was assumed the PRGs were agreed upon by the Agencies. For easy reference, however, a summary of

a. This RAO pertains to site TSF-08, which was not evaluated in this FS Supplement.

the PRGs established for OU 1-10 site COCs as reported in the Comprehensive RI/FS is presented in Table 3-1. The estimated areas and volumes of contamination at each site were also not re-assessed in this FS Supplement. The estimated areas and volumes of contamination at each site, as reported in the Comprehensive FS, are presented in Tables 3-2 and 3-3.

Table 3-1. Soil preliminary remediation goals (PRGs) by contaminant of concern (COC) and site.

Site	COC	PRG
TSF-26 PM-2A Tanks	Cesium-137	2.33 E+01 pCi/g
TSF-03 and WRRTF-01 Burn Pits	Lead	400 ppm
WRRTF-13 Fuel Leak	Total Petroleum Hydrocarbons	1,000 mg/kg

Table 3-2. Areas and volume of contaminated soil based on the preliminary remediation goals (PRGs).[b]

Site	Area (m^2 [ft^2])	Depth of Cover (m [ft])	Contaminated Interval (m [ft])	Volume (m^3 [ft^3])
TSF-26 PM-2A Tanks	—	0	—	3,891 (137,400)
TSF-03 Burn Pit	155 (1,664)	0.61 (2)	3.05 (10)	471 (16,640)
WRRTF-01 Burn Pit	1.21 (13)	1.22 (4)	1.83 (6)	2.21 (78)
	1.21 (13)	1.00 (3)	2.13 (7)	2.58 (91)
	1.21 (13)	0.15 (0.5)	2.90 (9.5)	3.51 (124)
	1.21 (13)	2.74 (9)	0.30 (1)	0.37 (13)
WRRTF-13 Fuel Leak	171 (1,840)	1.52 (5)	1.52 (5)	260 (9,180)
	30 (324)	2.44 (8)	0.61 (2)	18 (648)
	9 (100)	1.83 (6)	1.22 (4)	11 (405)

Table 3-3. Volume of TSF-26 PM-2A tanks waste liquid and sludge.[b]

Tank	Tank Capacity (L [gal])	Liquid Volume (L [gal])	Sludge Volume (L [gal])
V-13	189,271 (50,000)	189 (50)	7,192 (1,900)
V-14	189,271 (50,000)	189 (50)	1,325 (350)

b. Information in Tables 3.2 and 3.3 is compiled from the Comprehensive RI/FS, which provides detailed information on how areas and volumes were determined.

4. ALTERNATIVES EVALUATED IN THIS SUPPLEMENT

This section presents alternatives not previously considered, alternatives that have been modified, or alternatives that were reevaluated based on new or updated information. For the TSF-26 PM-2A tanks and WRRTF-13 Fuel Leak, numbering of the alternatives corresponds to the previous numbering of alternatives in the Comprehensive RI/FS. For new alternatives, the numbers reflect the next sequential number following the last previously evaluated alternative in the Comprehensive RI/FS.

4.1 TSF-26 PM-2A Tank Contents and Contaminated Soils

Alternatives evaluated in the Comprehensive RI/FS for TSF-26 are:

- Alternative 1—No Action/Limited Action
- Alternative 2a—Soil Excavation, Tank Removal, and On-Site Treatment and Disposal
- Alternative 2b—Soil Excavation, Tank Removal, On-Site Treatment, and Off-Site Disposal
- Alternative 2c—Soil Excavation, Tank Removal, and Off-Site Treatment and Disposal
- Alternative 3a—Soil Excavation, Tank Content Removal, and On-Site Treatment and Disposal
- Alternative 3b—Soil Excavation, Tank Content Removal, On-Site Treatment, and Off-Site Disposal
- Alternative 3c—Soil Excavation, Tank Content Removal, Off-Site Treatment, and Off-Site Disposal[c]
- Alternative 4a—Soil Excavation, In Situ Treatment of Tank Contents, and On-Site Soil Disposal
- Alternative 4b—Soil Excavation, In Situ Treatment of Tank Contents, and Off-Site Soil Disposal
- Alternative 5a—Soil Excavation, In Situ Vitrification of Tank Contents, and On-Site Soil Disposal
- Alternative 5b—Soil Excavation, In Situ Vitrification of Tank Contents, and Off-Site Soil Disposal.

Alternative 3d has been added to evaluate additional options for tank content removal and treatment, tank closure, and disposal of contaminated wastes.

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c. Alternative 3c was screened out in the Comprehensive RI/FS due to cost considerations, and will not discussed further in this FS Supplement.

4.1.1 Alternative 3d—Soil Excavation, Tank Content Vacuum Removal, Stabilization, and On-Site Disposal

Alternative 3d involves the excavation and disposal of the contaminated soils and removal and disposal of the tank contents (as described in Alternative 3a). Disposal of soils and waste is assumed to be on-site at the proposed INEEL soil repository or other approved facility, although disposal at a permitted off-site facility such as Envirocare is also possible. Additional tank waste sampling would be required to properly characterize the waste and determine if treatment is required. Waste characterization did not include RCRA waste analysis. Hence, a RCRA waste designation could not be determined. However, available characterization data indicate the waste may meet disposal criteria for a RCRA-compliant low-level waste landfill (such as the proposed INEEL soil repository or Envirocare). Although treatment is not anticipated, since the exact nature of the waste is unknown at this time, treatment requirements and options would be determined following additional waste characterization. Under Alternative 3d, the tank contents would be removed and treated (if necessary) prior to disposal as required. The tank would then be filled, as described for Alternatives 3a and 3b, with inert material (such as sand). The difference between the previously considered Alternatives 3a and 3b and the new Alternative 3d is consideration of additional tank waste removal and decontamination options that are available at potentially lower costs. Also, this alternative provides for a clean tank closure, which eliminates the need for further monitoring and control at the site.

4.2 TSF-03 and WRRTF-01 Burn Pits

Alternatives evaluated in the Comprehensive RI/FS for the burn pit sites included the following:

- Alternative 1—No Action/Limited Action
- Alternative 2—Native Soil Cover
- Alternative 3a—Excavation and Off-Site Disposal
- Alternative 4b—Excavation and Soil Washing On-Site.

4.2.1 Alternative 3b—Excavation and On-Site Disposal

This alternative was developed as a result of a general lack of data supporting the previous assessment of risks and proposed response actions. Alternative 3b would rely on initial sampling and analysis for potential contaminants. These contaminants include volatile organic compounds, semivolatile organic compounds, pesticides/polychlorinated biphenyls (PCBs), and metals. If, in addition to lead, other contaminants identified that exceed PRGs, excavation of contaminated soils exceeding PRGs and associated debris would be conducted using conventional earthmoving equipment. This would be followed by separation and temporary on-site storage of materials pending waste characterization sampling and analysis. The sampling results would be used to determine whether treatment would be required prior to off-site or on-site disposal. Excavated soils would be stockpiled. Composite samples of stockpiled soils would be analyzed for specific COCs identified in the pre-excavation sampling. Treatment options would be utilized only as required based on the hazardous waste characterization results. Wastes not exceeding Resource Conservation and Recovery Act (RCRA) hazardous waste criteria would be disposed of at the proposed INEEL soil repository or other suitable disposal site.

Any residual soil in the debris would be removed through a physical screening process. If required to meet disposal criteria, the debris would be encapsulated in polyethylene containers. The debris would be disposed of at an on-site or off-site repository (e.g., Envirocare in Utah). For purposes of cost estimation, the proposed on-site repository was considered for disposal of debris.

Verification sampling would be conducted to ensure that all concentrations exceeding PRGs were removed. If additional contaminants were identified, establishment of additional PRGs could be required at the time of waste characterization sampling. PRGs would be reviewed and approved by the Agencies prior to closure of the excavation.

4.3 WRRTF-13 Fuel Leak

The Comprehensive RI/FS evaluated the following alternatives for contaminated soils at WRRTF-13:

- Alternative 1—No Action/Limited Action
- Alternative 4—Excavation and Land Farming.

To address the concern that in situ biodegradation was not evaluated during the Comprehensive FS, Alternative 5 was added to this FS Supplement.

4.3.1 Alternative 5—In Situ Biodegradation Using Bioventing

Alternative 5 involves enhancing the natural biodegradation of petroleum-contaminated soils through a technology called bioventing. Bioventing is a way of introducing surface air into the subsurface soil to stimulate aerobic biodegradation of petroleum contaminants. The surface air is delivered through injection wells, which would be installed in a pattern based on the results of field pilot testing. This alternative was not previously considered. However, this commonly used and proven technology could be effective in reducing contamination at a significant cost savings over excavation and ex situ treatment options such as land farming, or long-term monitoring and institutional controls.

5. DETAILED ANALYSIS OF ALTERNATIVES

The alternatives developed as part of this FS Supplement are described in detail in this section. In addition, this section presents a detailed analysis of these alternatives against the following seven of the nine EPA evaluation criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Short-term effectiveness
- Reduction of toxicity, mobility, or volume through treatment
- Implementability
- Cost.

The other two criteria (state and community acceptance) will be evaluated following the public comment period on the Proposed Plan.

The analyses presented in the Comprehensive RI/FS remain valid except where specifically noted in this FS Supplement. The results presented in this Section 5 for the additional or reevaluated alternatives are compared against the previous results in Section 6. In addition, Section 6 presents the comparative analysis for all the alternatives evaluated for a site, including alternatives presented in the Comprehensive RI/FS as well as in this FS Supplement.

5.1 Purpose and Scope of the Detailed Analysis

The first step in the detailed analysis is to assess the developed alternatives against the seven evaluation criteria to form the basis for selecting a final remedial action. The analysis provides the information necessary to allow the Agencies to select an alternative that meets the primary goals of protecting human health and the environment, is technically feasible, and, where possible, is cost effective compared with other alternatives. The following sections provide the results of the detailed analysis of the additional alternatives against the evaluation criteria. Estimated costs associated with each alternative are presented in Appendix A.

The second step is the comparative analysis (see Section 6). In this step, each alternative is compared against the others in terms of its ability to meet the evaluation criteria, ARARs, established RAOs, and PRGs. Table 5-1 provides a summary of the ARARs and to be considered criteria, advisories, or guidance (TBCs) that apply to the WAG 1 sites. This table was copied from the Comprehensive RI/FS approved by the agencies and is provided for the convenience of the reader. In this supplement, there was no effort to re-evaluate the ARARs. These ARARs are preliminary; a detailed evaluation of ARARs specific to the preferred alternatives will be conducted during development of the ROD.

5.1.1 ARAR Waivers Required

ARAR waivers will be required for WAG 1 as indicated in Table 5-2.

Table 5-1. Compliance ARARs and TBCs for WAG 1 sites.

Regulation, Statute, or Order	Citation	Applicability: Mixed Low-Level Contaminated Soil/Sediment	Nonradionuclide-Contaminated Soil/Sediment	V-Tanks (TSF-09/18)	PM-2A Tanks (TSF-26)
ARARs					
Idaho Hazardous Waste Management Act	IDAPA 16.01.05.005 (40 CFR 261) IDAPA 16.01.05.006 (40 CFR 262.11) IDAPA 16.01.05.007 IDAPA 16.01.05.008 (40 CFR 264) IDAPA 16.01.05.009 IDAPA 16.01.05.010 IDAPA 16.01.05.011 (40 CFR 268)	✓	✓	✓	✓
Toxic Substances	IDAPA 16.01.01.161	✓	✓	✓	✓
National Pollutant Discharge Elimination System	40 CFR 122.26	✓		✓	✓
Toxic Substances Control—PCBs	40 CFR 761			✓	
PCB Marking Requirements	40 CFR 761.40(a)(1), (a)(9), (a)(10), (e), (h)			✓	
Disposal of Rags, Debris after Remedial Action	40 CFR 761.60(a)(4)			✓	
Disposal of PCB Containers after Remedial Action	40 CFR 761.60(c)			✓	
PCB Spill Cleanup During Remedial Action	40 CFR 761.60(d)			✓	
Storage of PCB Waste	40 CFR 765.65(b) except (b)(v)			✓	
30-Day Storage of PCB Waste During Remedial Action	40 CFR 761.65(b)			✓	
PCB Waste Inspections	40 CFR 761.65(c)(5)			✓	
PCB Container Requirements	40 CFR 761.65(c)(6) and (c)(7)			✓	
Placing a Date on PCB Containers	40 CFR 761.65(c)(8)			✓	
PCB Landfill Technical Requirements	40 CFR 761.75(b)(3), (b)(4), (b)(5), (b)(6)(ii), (b)(6)(iii), and (b)(7)(i)			✓	
PCB Spill Cleanup During Remedial Action	40 CFR 761.125 and .130			✓	✓
Manifesting PCB Waste Offsite	40 CFR 761.207 and .208			✓	✓
Evaluate Federal Projects for Impact to Endangered or Threatened Species or Critical Habitats	50 CFR 402.12	✓			
Evaluate DOE Projects for Potential Floodplain and Wetland Impact	10 CFR 1022	✓			
Idaho Fugitive Dust Emissions	IDAPA 16.01.01.650 and .651	✓	✓	✓	✓

Table 5-1. (continued).

Regulation, Statute, or Order	Citation	Applicability: Mixed Low-Level Contaminated Soil/Sediment	Nonradionuclide-Contaminated Soil/Sediment	V-Tanks (TSF-09/18)	PM-2A Tanks (TSF-26)
Hazardous Waste Determination	40 CFR 262.11			✓	✓
Accumulation of Hazardous Waste	40 CFR 262.34(a)(1), (2)(c)(1), and (4)			✓	✓
General Waste Analysis	40 CFR 264.13(a)(1),(a)(2)	✓	✓	✓	✓
Security	40 CFR 264.14	✓	✓	✓	✓
General Inspection	40 CFR 264.15	✓	✓	✓	✓
Personnel Training	40 CFR 264.16	✓	✓	✓	✓
Location Standards	40 CFR 264.18(a)	✓	✓	✓	✓
Preparedness and Prevention	40 CFR Subpart C	✓	✓	✓	✓
Emergency Planning	40 CFR 264 Subpart D except 264.56(j)	✓	✓	✓	✓
Operating Record	40 CFR 264.73, except 264.73(b)(8)	✓	✓	✓	✓
Miscellaneous Units	40 CFR Subpart X	TBD	TBD	TBD	TBD
Land Disposal Restrictions (LDRs) for Secondary Waste	40 CFR 268.7, 9, .40, .45, .48				
Rules for Solid Waste Management	IDAPA 16.01.06.004		✓		
Flood Plains	40 CFR 257.3-1(a)		✓		
Groundwater	40 CFR 257.3-4(a)		✓		
Idaho Water Quality	IDAPA 16.01.02.299(5)(a) and (b)	✓	✓	✓	✓
Idaho Ground Water Quality Rule	IDAPA 16.01.11.200	✓	✓	✓	✓
Container Standards	40 CFR 264 Subpart I except .179			✓	✓
New Tanks Systems	40 CFR 264.192 (except certifications will not be submitted)			✓	✓
Containment and Detection of Releases	40 CFR 264.193			✓	✓
General Operating Requirements	40 CFR 264.194			✓	✓
Inspections	40 CFR 264.195			✓	✓
Response to Spills and Leaks	40 CFR 264.196			✓	✓
Closure	40 CFR 264.197(a) and (b)			✓	✓
Incompatible Waste	40 CFR 264.199			✓	✓
Requirements for Portable Equipment	IDAPA 16.01.01.500.02	✓	✓	✓	✓
NESHAPS—Mercury	40 CFR 61.52(b)			✓	
Mercury Emissions Testing	40 CFR 61.53(d), .54			✓	

Table 5-1. (continued).

Regulation, Statute, or Order	Citation	Applicability: Mixed Low-Level Contaminated Soil/Sediment	Nonradionuclide-Contaminated Soil/Sediment	V-Tanks (TSF-09/18)	PM-2A Tanks (TSF-26)
Mercury Emissions Monitoring	40 CFR 61.55			✓	
Ground Water Protection Standard	40 CFR 264.92		✓	✓	✓
Hazardous Constituents	40 CFR 264.92		✓	✓	✓
Point of Compliance	40 CFR 264.93		✓	✓	✓
Ground Water Monitoring Requirements	40 CFR 264.97		✓	✓	✓
Detection Monitoring Program	40 CFR 264.98(a), (b), (c), (d), (e), and (f)		✓	✓	✓
Closure Performance Standards	40 CFR 264.111(a) and (b) and .114			✓	✓
Closure and Post Closure	40 CFR 264.310(a)(1), (2), (3), (4), (5); (b)(1), (4), (5), (6)		✓	✓	✓
Surveying and Record Keeping	40 CFR 264.309(a) and (b)		✓	✓	✓
Assessment of Existing Tank Systems	40 CFR 264.191(a), (b), and (d)			✓	✓
Preconstruction Compliance with Toxic Standards	IDAPA 16.01.01.210				
NESHAPS—Radionuclide Emissions from DOE facilities (other than Radon-222 and Radon-220 at DOE Facilities-Emission Standard)	40 CFR 61.92	✓	✓	✓	✓
Emission Monitoring	40 CFR 61.93	✓	✓	✓	✓
Emission Compliance	40 CFR 61.94			✓	✓
Rules for the Control of Air Pollution in Idaho (Air Toxins Rules) Toxic Air Emissions	IDAPA 16.01.01585 and 16.01.01586	✓	✓	✓	✓
Landmarks, Historical, and Archaeological Sites	40 CFR 6.301	unlikely	unlikely	unlikely	unlikely
Migratory Bird Conservation	16 USC 715	✓			
Requirements for Land Disposal of Radioactive Waste	10 CFR 61	✓		✓	✓
Location Standards	40 CFR 264.18(a)	✓	✓	✓	
Preparedness and Prevention	40 CFR Subpart C	✓	✓	✓	
Emergency Planning	40 CFR 264 Subpart D, except 264.56(j)	✓	✓	✓	
Operating Record	40 CFR 264.73, except 264.73(b)(8)	✓	✓	✓	
National Historic Preservation Act	16 USC 470 et seq.	✓	✓	✓	✓

Table 5-1. (continued).

Regulation, Statute, or Order	Citation	Applicability: Mixed Low-Level Contaminated Soil/Sediment	Nonradionuclide-Contaminated Soil/Sediment	V-Tanks (TSF-09/18)	PM-2A Tanks (TSF-26)
Storm Water Discharges	40 CFR 122.26	✓	✓	✓	✓
TBCs					
Environmental Protection, Safety, and Health Protection Standards	DOE Order 5480.4	✓	✓	✓	✓
Radioactive Waste Management	DOE Order 5820.2A	✓	✓		✓
Radiation Protection of the Public and Environment	DOE Order 5400.5	✓	✓		✓
Hazardous and Mixed Waste Program	DOE Order 5400.3		✓	✓	✓
Environmental Protection, Safety and Health Protection Standard	DOE Order 5480.4	✓	✓	✓	✓
Residual Radioactive Material in Soil	DOE Order 5400.5, Chapter IV	✓		✓	✓
Low-Level Radioactive Waste Management	DOE Order 5820.2A, Chapter III	✓		✓	✓
General Design Criteria	DOE Order 6430.1A			✓	✓

Table 5-2. Compliance ARARs and TBCs for WAG 1 sites.

Regulation	Citation	Waiver
Incineration of Mineral Oil PCB Waste	40 CFR 761.60(a)(1)	Waste with contamination at > 500 ppm will be treated by grouting rather than by the required technology of incineration with 99.9999% destruction.
Incineration of Nonmineral Oil PCB Waste	40 CFR 761.60((a)(3)(i))	Waste with contamination at > 500 ppm will be treated and disposed of by grouting rather than by the required technology of incineration with 99.9999% destruction.
Chemical Waste Landfill Required for Mineral Oil	40 CFR 761.60(a)(2)(ii)	Waste with contamination between 50 and 500 ppm PCBs will be treated and disposed of by grouting rather than the allowed alternatives of disposal in a Toxic Substances Control Act (TSCA) -permitted chemical waste landfill, combustion in a TSCA-approved boiler, chemical dehalogenation by the sodium/glycol method, or incineration in a TSCA-approved incinerator.
Chemical Waste Landfill for Liquid PCBs Other Than Mineral Oil	40 CFR 761.60(a)(3)(ii)	Waste with contamination between 50 and 500 ppm PCBs will be treated and disposed of by grouting rather than by the allowed alternatives of disposal in a TSCA-permitted chemical waste landfill, combustion in a TSCA-approved boiler, chemical dehalogenation by the sodium/glycol method, or incineration in a TSCA-approved incinerator.
PCB Storage in 100-Year Flood Plain	40 CFR 761.65(b)(v)	Waste contaminated with > 50 ppm PCBs will be land disposed of in the Birch Creek 100-year flood plain.
RCRA Location Standards	40 CFR 264.18(b)	Hazardous and mixed waste will be land disposed of in the Birch Creek 100-year flood plain (unless delisting occurs in the Record of Decision).
LDR-required Technology for High Mercury Waste If Placement Occurs	40 CFR 268.40	If V-Tank waste is removed from the tank for grouting, then placement has occurred and the LDR technology standard of incineration and retorting for high mercury waste will apply. Grouting will not achieve the standard.

5.2 Remedial Alternatives for TSF-26 PM-2A Tanks

5.2.1 Alternative 3d—Soil Excavation, Tank Content Vacuum Removal, Stabilization, and On-Site Disposal

A new and currently available technology at the INEEL to remove waste from the tanks was evaluated for cost effectiveness. Alternative 3d has been developed to address this waste removal option. The other portions, of Alternative 3d are essentially the same as Alternatives 3a and 3b.

Alternative Description. Alternative 3d has been developed to supplement Alternatives 3a and 3b, which called for soil removal, tank content removal, on-site treatment, and on-site (3a) or off-site (3b) disposal. Alternative 3d differs from Alternatives 3a and 3b in that an alternative waste removal option is evaluated.

Under this alternative, standard excavation equipment would be used to remove contaminated soils surrounding the tanks. Five distinct areas of radionuclide-contaminated soils would be excavated (as shown on Figures 5-1 and 5-2). Modifications to the excavation equipment would be made as needed to provide shielding (e.g., lead windows and lead lining on exterior-facing surfaces) and personal exposure protection (e.g., supplied air, positive-pressure ventilation systems, and HEPA filters). Utilizing radiological screening, uncontaminated soils (those with activities less than the PRGs) would be stockpiled separately from the contaminated soils.

Waste would be removed from the tanks using commercially available vacuum excavation technology. Vacuum excavation utilizes the kinetic energy of a high-velocity air stream to penetrate, expand, and break up solids and slurries. The loosened materials are captured by a high-powered vacuum air stream. The excavation head removes 2 to 5 inches of solids in a single pass and can work at depths greater than 20 feet. Commercial applications include soils, tanks, vaults, and underground storage tanks. Waste from the tanks would be removed without the addition of any liquids.

Waste characterization sampling would be conducted on soil stockpiles to allow proper disposal. Based on the sampling results, uncontaminated soils would be returned to the excavation. Verification sampling within the excavation would be conducted prior to backfilling with uncontaminated soils. Treatment of soils is not anticipated, but options for treatment would be further evaluated upon receipt of the waste characterization data. Due to uncertainties in the waste contaminants, more than one treatment step could be required.

Based on the RI results, the sludge associated with the TSF-26 PM-2A tank is considered to be F001-listed waste. Although initial analysis was not performed per RCRA protocols and an accurate RCRA waste determination cannot be made, the results indicate the waste may possibly meet disposal criteria for a RCRA-compliant low-level waste landfill. Additional sampling would be required to verify treatment is not required prior to disposal. Treatment, if required, would most likely consist of chemical stabilization since it is assumed from available analytical results the TCE for which the waste is coded F001 may be below the LDR criteria, but the waste may be characteristic for metals. If the organic concentrations exceed disposal criteria, a proven technology such as thermal desorption or incineration could be used.

Following removal and possible on-site treatment, the waste would be disposed of on-site or off-site. For cost estimating purposes, disposal at the proposed INEEL soil repository was assumed. If treatment by stabilization is required, treatability tests may be necessary to ensure that the stabilized waste met the land disposal requirements for the permitted facility. Mixing of the sludge with the stabilizing

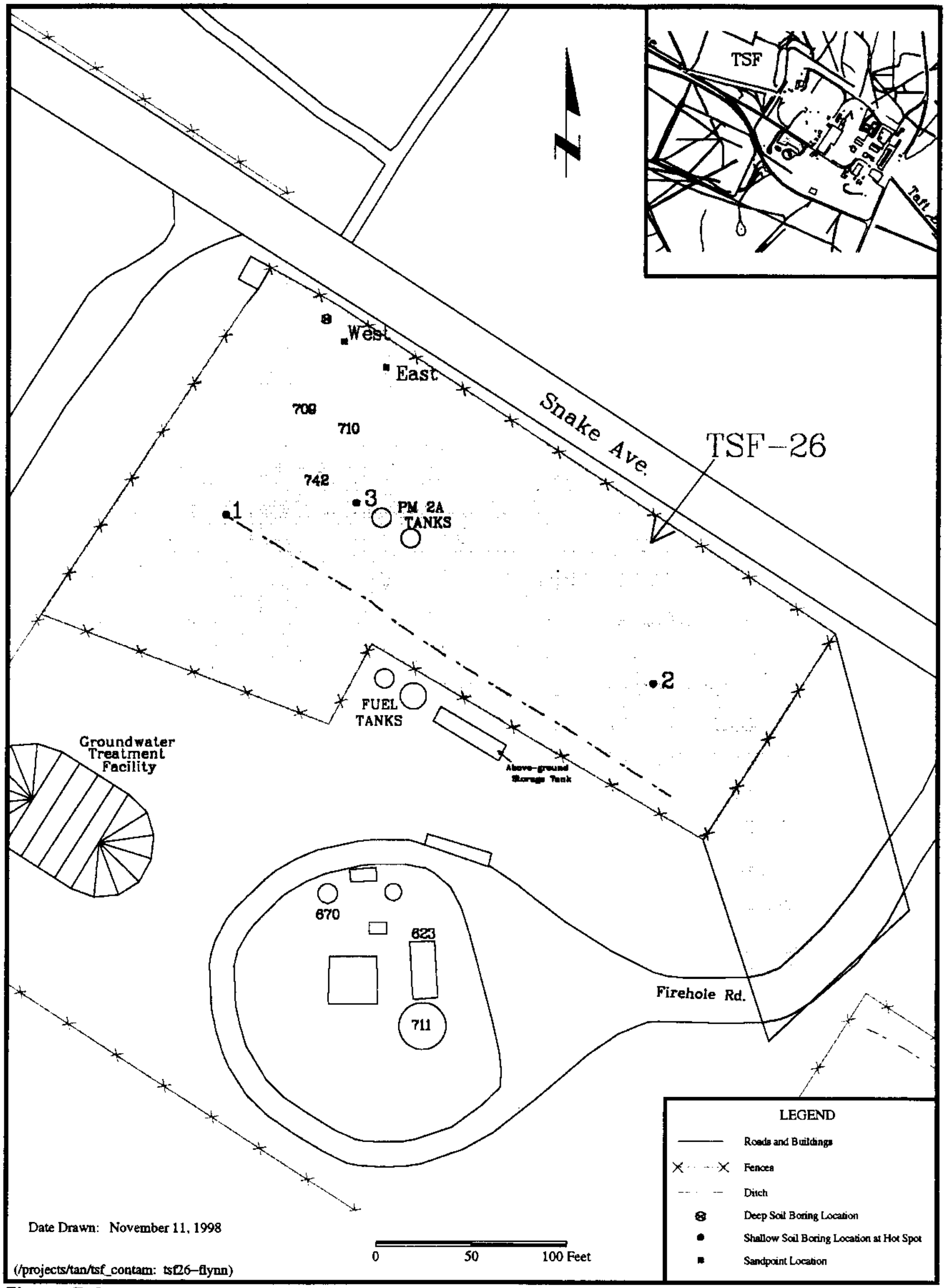
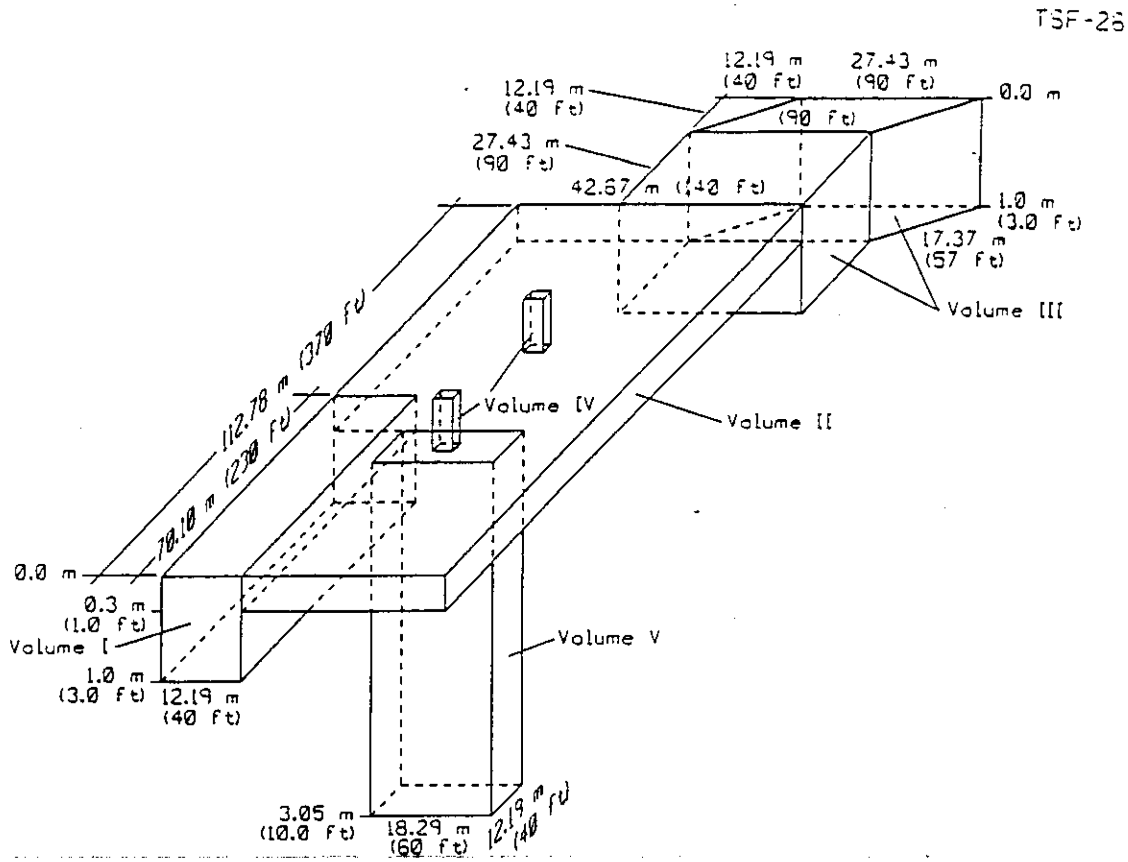


Figure 5-1. Location of TSF-26 PM-2A tank.



<u>Contaminated Soil Volume Descriptions</u>[a]

Vol. I: 1 m (3 ft) deep contamination in NW of site
Vol. II: 0.3 mm (1 ft) deep contamination over most of the fenced area
Vol. III: 1 m (3 ft) deep contamination outside of east fence
Vol. IV: Stockpiled soil[b]
Vol. V: 3 m (10 ft) deep contamination around tanks[c]

<u>Volume Estimates:</u>

Vol. I: (230 ft) (40 ft) (3 ft) = 27,600 ft^3
Vol. II: ((370 ft) (140 ft) – (230 ft) (40 ft)) (1 ft) = 42,600 ft
Vol. III: ((90 ft) (90 ft) + (90 ft)) (3 ft) = 35,100 ft^3
Vol. IV: (assumed): (300 yd^3) (27 ft^3/yd^3) = 8,100 ft^3
Vol. V: (60 ft) (40 ft) (10 ft) = 24,000 ft^3
Total = 137,400 ft^3

<u>Notes:</u>

a. The volume of contaminated soil shown in the figure is based on field observations taken during the OU 10-06 nontime critical removal action.

b. Volume IV consists of a total of 229m^3 (300 yd^3) of contaminated soil in two stockpiles.

c. Contamination around the tanks extends deeper than 3 m (10 ft), but remediation of the top 3 m of soil will prevent exposures to workers and potential future residents at the site.

Figure 5-2. TSF-26 PM-2A volume assumption.

materials would be conducted using readily available conventional equipment. Treatability testing would not be required for thermal treatment.

Evaluation

Overall Protection of Human Health and the Environment. Alternative 3d would be effective for the long-term protection of human health through removal of contaminants from the soil pathway and removal of contaminants from the tank followed by treatment (if required) and disposal of wastes, tank decontamination, and closure. This would eliminate the potential for future direct contact with or exposure to site contaminants. The potential treatment processes would result in generation of some residual concentrated wastes. These would require disposal in a permitted disposal facility to ensure long-term protection of human health and the environment.

Compliance with ARARs and TBCs. All ARARs and TBCs would be met. Compliance with emission-control ARARs would be ensured during the excavation and hauling activities by the use of standard engineering controls, including water sprays for dust suppression. Engineering controls for regulating storm runoff during excavation activities would be implemented to meet 40 CFR 122.26 regulations. Personnel radiation exposure (10 CFR 835) would be maintained at levels as low as reasonably achievable (ALARA) through engineering and administrative controls. State of Idaho waste characterization, management, and disposal regulations would be met by this alternative. All RCRA tank closure requirements will be met.

Long-Term Effectiveness and Permanence. This alternative would provide for long-term and permanent prevention of human and environmental exposure to contaminated soils and contaminated tank contents. The long-term effectiveness would be dependent on the proper management of the treated and/or untreated wastes at an on-site or off-site disposal facility. With removal from TSF-26 followed by proper treatment (if required) and disposal, this alternative would provide a high degree of effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume through Treatment. Placement of the residual radionuclide-contaminated soils in an on-site disposal facility would reduce contaminant mobility. Disposal of the tank contents in a RCRA-compliant facility would reduce contaminant mobility. Treatment, if required, would further reduce mobility.

Short-Term Effectiveness. The risk of exposure to workers during soil excavation and haulage, tank content removal and treatment, and investigation-derived waste characterization and disposal would be moderate since the soils and tank wastes have only low concentrations of radionuclides and hazardous chemicals. However, engineering and administrative controls would be utilized to minimize potential exposures. Radiation monitoring and control measures would be enforced throughout the alternative's implementation. ALARA principles would be adhered to. Depending on radiation-monitoring results, equipment operators could be required to install shielding apparatus (i.e., leaded windows and lead lining on exterior surfaces of the equipment) depending on radiation monitoring results. Proper PPE would be required for all personnel. Excavation equipment also could be required to have positive-pressure ventilation system cabs and HEPA filters for use in radioactively contaminated areas. These types of engineering controls have been shown to be effective at other areas of the INEEL.

Excavation and disposal activities also could pose physical hazards, such as vehicle accidents and physical injuries. However, implementation of proper health and safety measures would minimize these risks. Environmental impacts from this alternative would be considered to be small and short-term since TSF-26 is located in an already disturbed area with frequent human activity. The site does not provide any critical habitats or archaeological or historical sites.

Following completion of the excavation activities, the site would be restored by backfilling the excavation with clean soils and grading the surface to match the surrounding landscape.

Implementability. This alternative would be technically feasible and would employ technologies that are currently available at the INEEL. Observations of the waste during sampling indicate that commercially available, high-powered industrial vacuums would be able to remove all the waste from the tanks without difficulty. Several appropriate vacuum systems are currently available for use at the INEEL. Due to the high proportion of diatomaceous earth to sludge, and the low concentration of organics, radionuclides, and metals the development of a treatment process would not be difficult.

Cost. The costs associated with Alternative 3d are presented in Appendix A and summarized in Table 5-3.

Table 5-3. Cost of Alternative 3d for TSF-26, PM-2A tanks site (TSF-26).

Alternative	Capital Costs (Net present value)	Operating Costs (Net present value)	Total Costs (Net present value)
Alternative 3d	$6,269,801	NA	$6,269,801

5.3 Remedial Alternatives for TSF-03 and WRRTF-01 Burn Pits

An unresolved issue raised for the TSF-03 and WRRTF-01 burn pit sites regards the type and extent of contamination. The Comprehensive RI/FS identified only lead as a COC at these sites. However, additional COCs may be present in the soils at the burn pits. (The location of the TSF-03 and WRRTF-01 burn pits and sampling locations are shown on Figures 5-3 and 5-4, respectively.)

Activities at these sites very likely included the burning of used petroleum products and solvents. Therefore, a potential for PCB contamination exists; in addition, open burning of petroleum products and chlorinated chemicals could result in the production of dioxins/furans. Recent investigation into available records also indicates that other toxic substances, such as beryllium, chlorinated solvents, and used oils were disposed of in the pits. Further contaminants may include pesticides and additional metals. Previous sampling did not address these possible contaminants.

The Comprehensive RI/FS assumed that the existing soil cover was 2 to 2.5 feet thick over the entire pit area. However, the existing soil cover varies from less than 6 inches to more than 9 feet thick. Because of the variation in soil thickness and potential for other COCs to be present above risk-based levels at the site, long-term protection of human health and the environment may not be assured under the No Action/Limited Action alternative.

Since the Comprehensive RI/FS was prepared, a potential on-site disposal option has been identified that will comply with RCRA landfill requirements. This option could, therefore, reduce the cost of excavation and disposal. In the new alternative, the excavation and disposal option has been reevaluated by considered on-site disposal. For the purpose of this FS Supplement, the assumptions for Alternative 3 (excavation and off-site disposal) were used as a basis to cost estimate an on-site disposal option at the proposed INEEL soil repository.

5.3.1 Alternative 3b—Excavation and On-Site Disposal

Alternative Description. Alternative 3b involves additional sampling and analysis, excavation and disposal of contaminated soils and debris at the proposed INEEL soil repository. Under Alternative 3 in

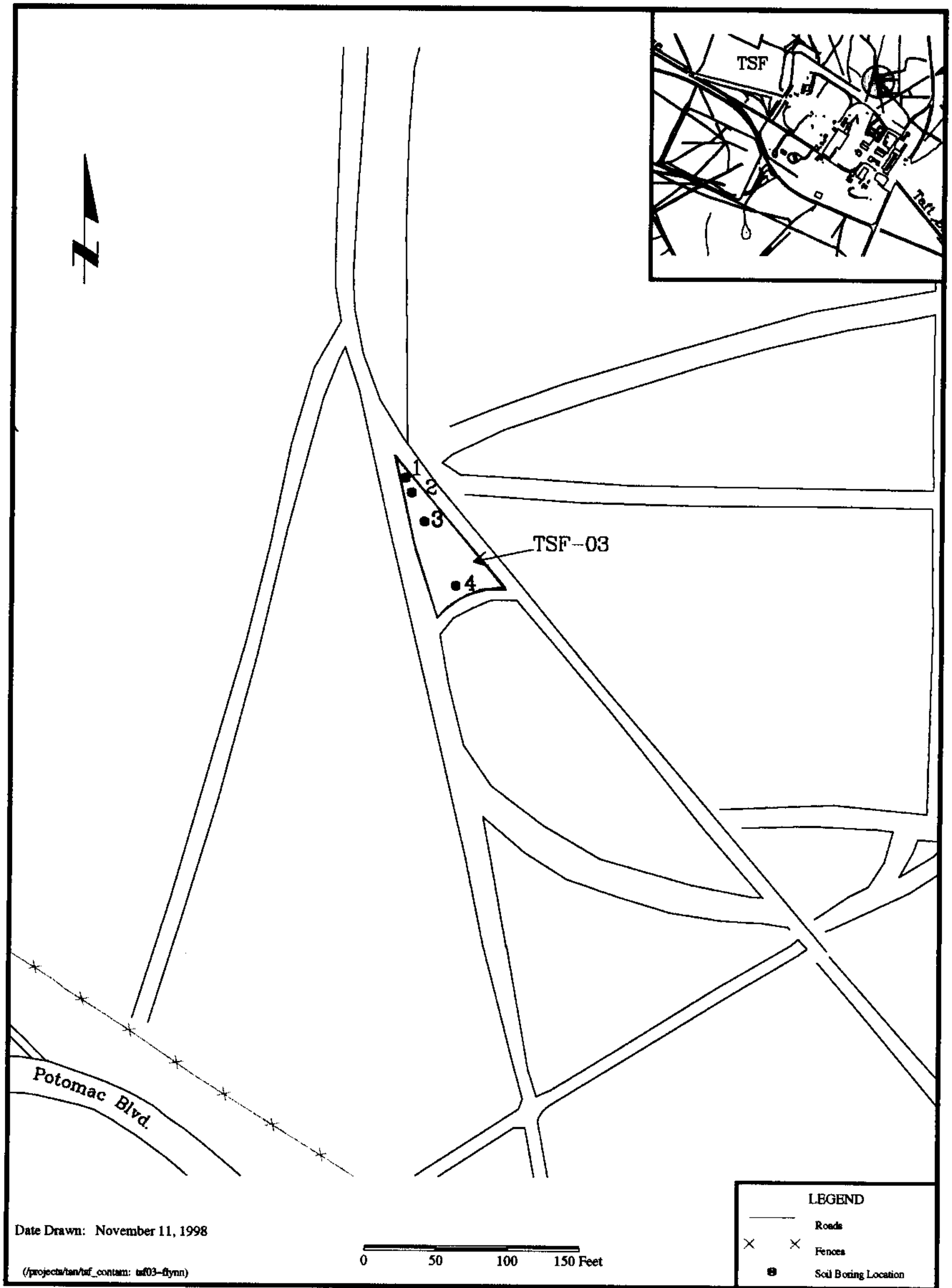


Figure 5-3. Location of the TSF–03 burn pit.

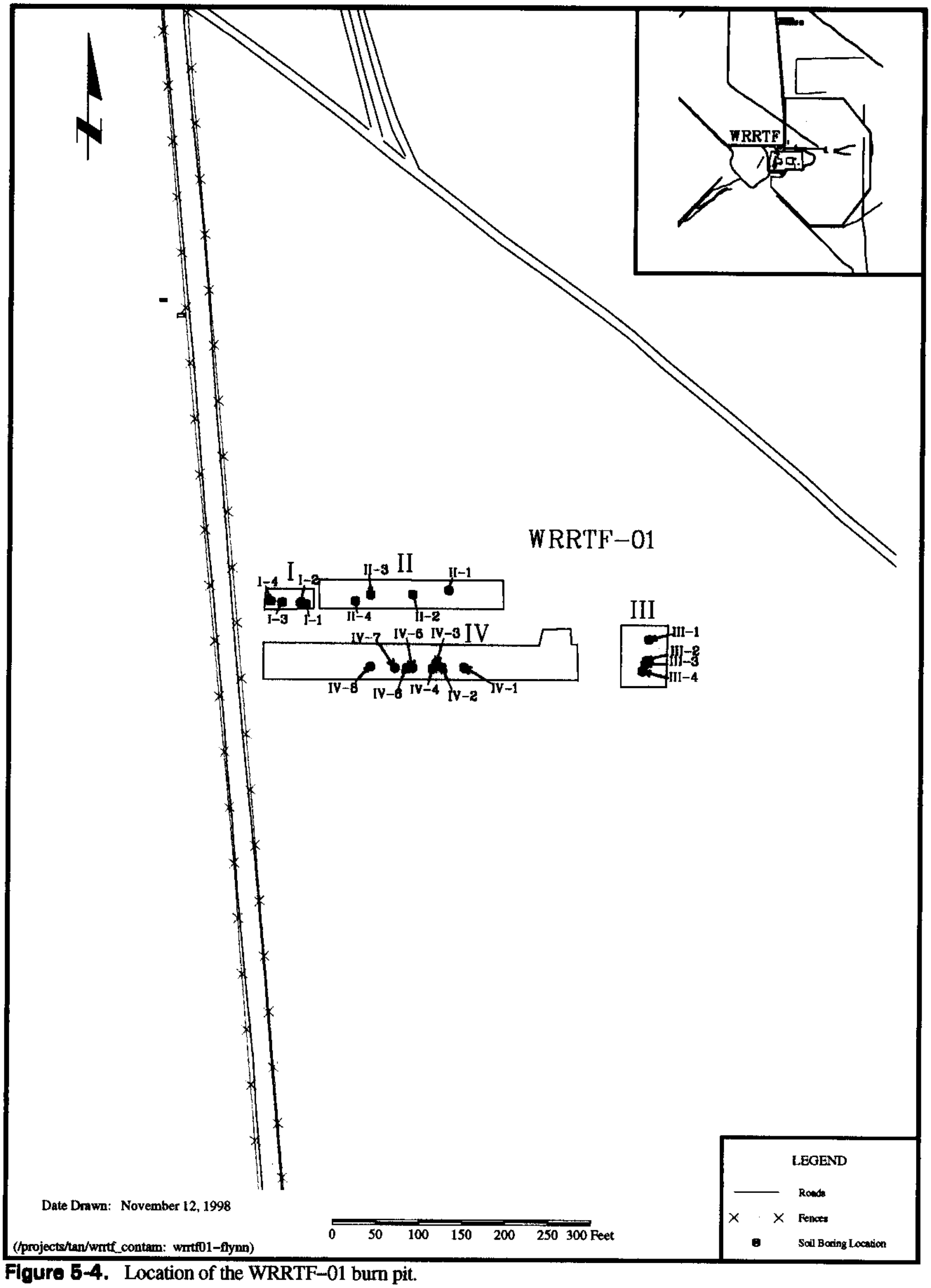


Figure 5-4. Location of the WRRTF-01 burn pit.

the Comprehensive RI/FS (now identified as Alternative 3a), it was assumed this waste could be disposed of at an off-site RCRA compliant without treatment. This same assumption was presumed valid for disposal in the proposed on-site soil repository. Sampling and analysis will be performed before and during excavation to determine if the wastes meet disposal criteria. For the purposes of this FS Supplement, the previously estimated volumes presented in the Comprehensive RI/FS for TSF-03 and WRRTF-01 (Figures 5-5 and 5-6, respectively) have been used. Excavation would be performed using conventional earthmoving equipment. Excavated soils would be stockpiled. The stockpile would be sampled and analyzed for hazardous waste characteristics based on potential COCs identified from the additional sampling. The hazardous waste characterization samples would consist of composite samples taken at variable depths and locations that are representative of the stockpile. Temporary storage of the stockpiled materials would be required pending results of the waste characterization sampling and analysis. The excavation would remain open pending results of the verification sampling for the identified COCs. Once verification samples indicated that all COCs were below the relevant PRGs, the excavation would be backfilled with clean native soils and the surface would be graded to match the surrounding landscape. Treatment options, if required, would be evaluated upon receipt of the waste characterization data. Residual wastes resulting from treatment would be disposed of on-site or off-site at a permitted facility.

Evaluation

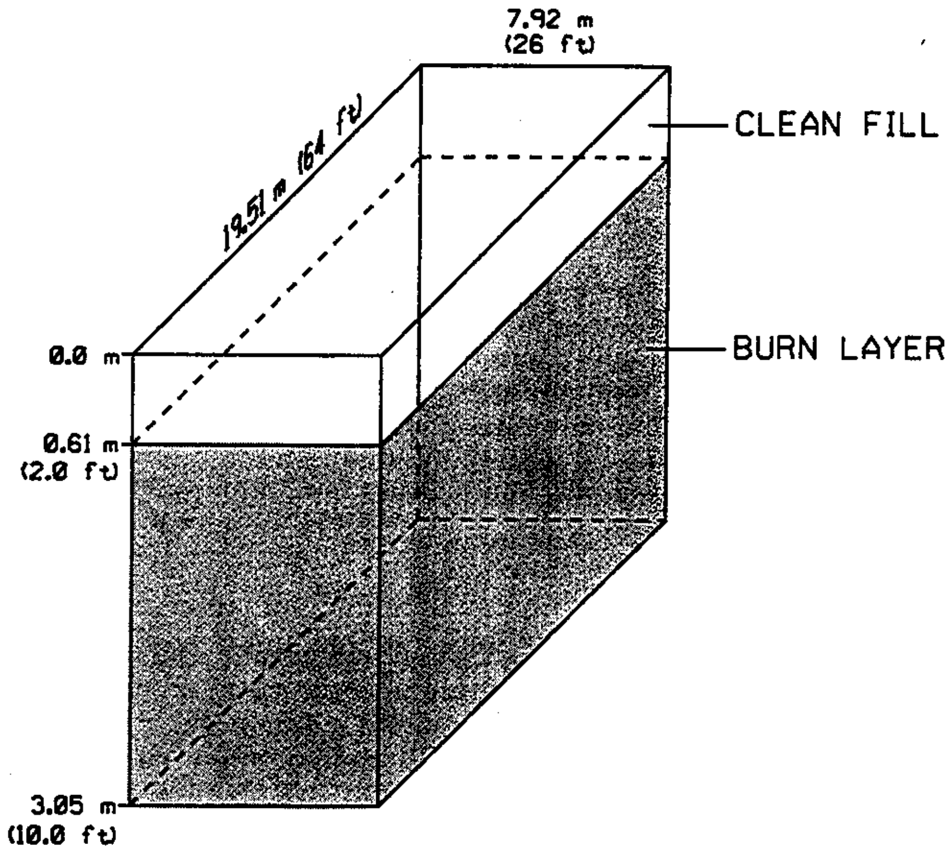
Overall Protection of Human Health and the Environment. Alternative 3b would provide highly effective long-term protection of human health and the environment. Additional waste characterization would ensure that any additional potential COCs, if present, were properly evaluated. Removal of the contaminated soils followed by treatment, if required, and disposal would eliminate the potential for human and environmental exposure associated with direct or indirect exposure to site contaminants. A small quantity of contaminants resulting from the potential treatment process would require properly permitted and controlled disposal to ensure overall long-term protection.

Compliance with ARARs and TBCs. This alternative complies with all ARARs and TBCs. Compliance with emission-control ARARs would be ensured during excavation and hauling activities by the use of standard engineering controls, including water sprays for dust suppression. Engineering controls for regulating storm runoff during excavation activities would be implemented to meet 40 CFR 122.26 regulations. State of Idaho waste characterization, management, transportation, and disposal regulations would be met by this alternative.

Long-Term Effectiveness and Permanence. Removal of site contaminants, treatment, and disposal of residuals would provide an effective and permanent solution to contaminated media at the burn sites. Backfilling with clean soils would provide long-term protection from any residual contamination present. As a result of contaminant removal, no long-term monitoring would be required at the burn pit sites. However, the treatment wastes would require long-term maintenance and control at an approved disposal facility.

Reduction of Toxicity, Mobility, or Volume through Treatment. If organic contaminants were found to be present and were subsequently treated by destructive methods (e.g., thermal desorption or incineration), reduction of contaminant toxicity could be achieved. A reduction in volume and mobility of metal contaminants would be achieved through contaminant removal and extraction through treatment (such as soil washing), if required.

Short-Term Effectiveness. Potential health risks to workers during excavation and removal of contaminated soils would be effectively mitigated using standard administrative and engineering controls, including dust suppression and appropriate personal protective equipment (PPE). Short-term



LEGEND

Zone of contamination.

ASSUMPTIONS:

- The volume of contaminated material is assumed from .61 m (2 ft) bgs (the minimum depth observed) to 3.05 m (10 ft) bgs (accounting for 2.44 m (8 ft) of maximum thickness observed).

Figure 5-5. TSF-03 volume assumption.

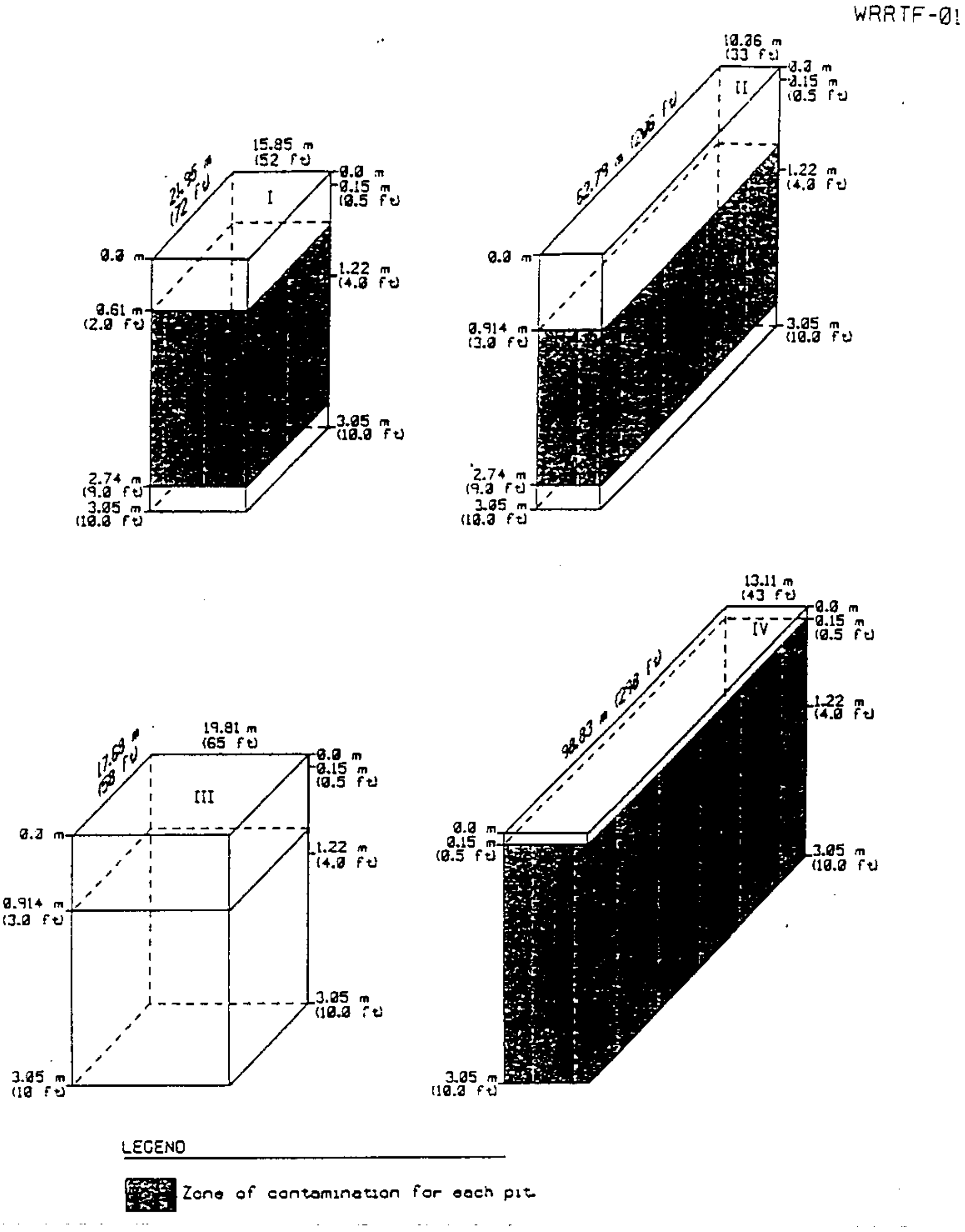


Figure 5-6. WRRTF-01 volume assumption.

environmental impacts would include vegetation disturbance and disruption of wildlife habitat. However, vegetation and wildlife habitat would be restored following completion of the remedial action. There are no known environmentally sensitive archaeological or historical sites, wetlands, or critical habitat at these sites.

Implementability. Alternative 3b is technically feasible using standard excavation and transportation equipment. Treatment technologies are available for the contaminants previously identified at the burn sites. If additional COCs were determined to be present, treatability testing could be required prior to implementation of other treatment technologies. Treatment technologies may or may not be locally available depending on treatment type. Further evaluation would be required if COCs other than lead were identified. A RCRA compliant disposal facility is planned for the INEEL and permitted disposal facilities exist within the INEEL region, hence acceptable disposal options will be available for residual wastes from treatment.

Cost. Costs for this alternative would include sampling and analysis of waste, excavation, transportation, and disposal at the proposed INEEL soil repository. Although it is assumed treatment prior to disposal will not be required, if sampling and analysis indicates treatment will be required, costs would vary greatly depending on the type of treatment, whether treatment was to be conducted on- or off-site, and the estimated quantities to be treated. Hence, treatment costs are not included in the estimated costs for this alternative. Cost estimates are presented in Appendix A and are summarized in Table 5-4.

Table 5-4. Cost of Alternative 3b for TSF-03 and WRRTF-01 burn pits.

Alternative 3b	Capital Costs (Net present value)	Operating Costs (Net present value)	Total Costs (Net present value)
TSF-03	$981,403	$0	$981,403
WRRTF-01	$5,039,646	$0	$5,039,646

5.4 Remedial Alternatives for WRRTF-13 Fuel Leak

Due to uncertainties in the effectiveness of in situ biological treatment processes for OU 1-10 sites of concern, these treatment processes were eliminated during the Comprehensive RI/FS screening process. Since then, however, in situ biological treatment has been demonstrated as a cost-effective and proven process at other petroleum-contaminated sites in the U.S.

5.4.1 Alternative 5—In Situ Biodegradation Using Bioventing

Alternative Description. Alternative 5 consists of in situ bioventing. Under this alternative, a network of injection wells would be installed in the petroleum-contaminated soils at WRRTF-13 (Figures 5-7 and 5-8). The wells would allow the introduction of oxygen to stimulate aerobic biodegradation of the contaminants. A lack of oxygen can limit the complete degradation of organic compounds. By delivering additional oxygen, the rate of biodegradation by indigenous microorganisms can be increased.

The network of injection wells would be connected to blowers by manifolds. Air would be continuously injected into the vadose zone at very low air-flow rates to minimize the amount of volatilization that might occur. The diesel fuels of WRRTF-13 are primarily high-molecular-weight hydrocarbons, so volatilization is expected to be at a low rate and off-gas treatment probably could be avoided. This technology is best suited to homogenous, coarse-grained soils (such as sand and gravel),

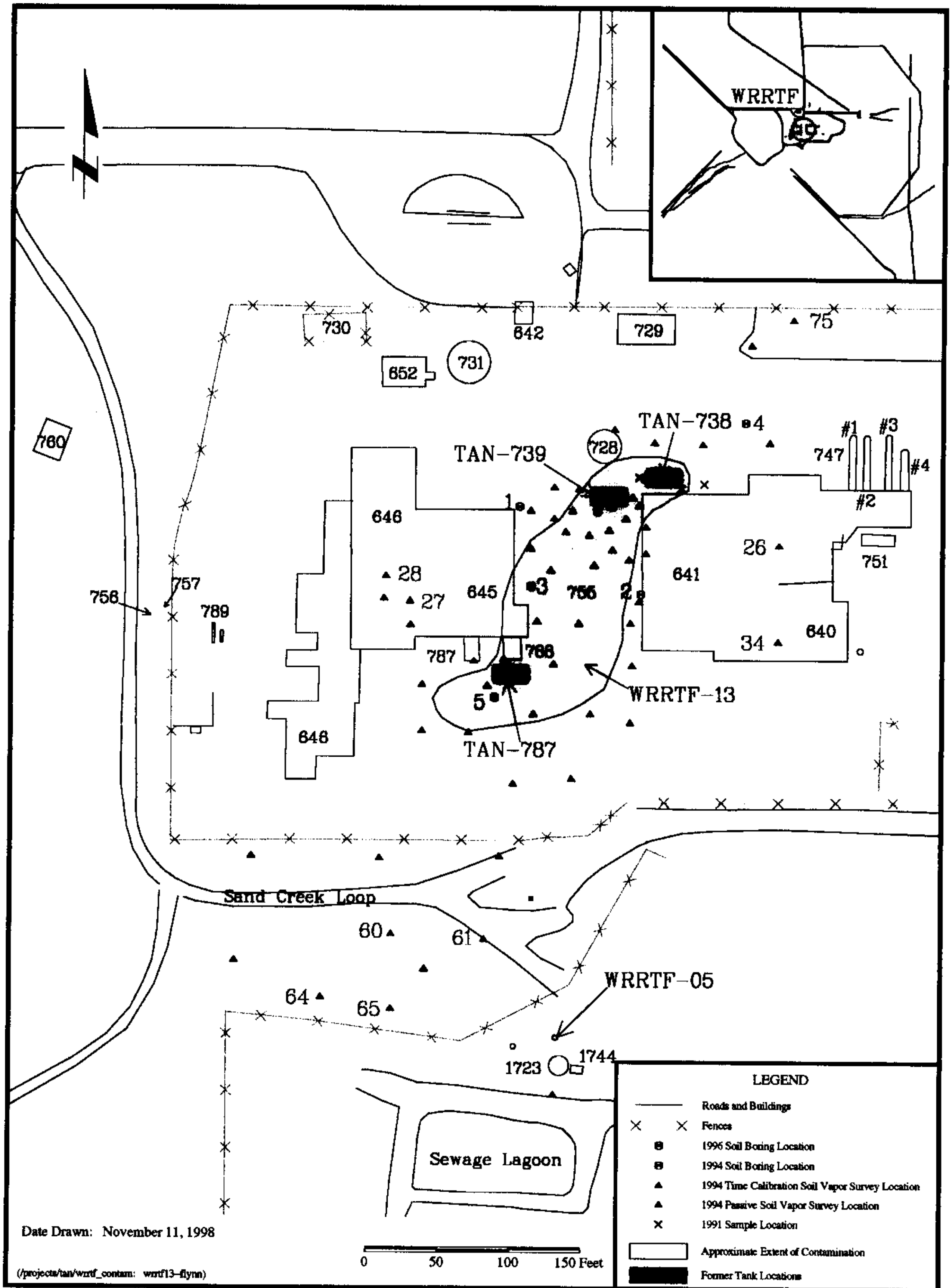
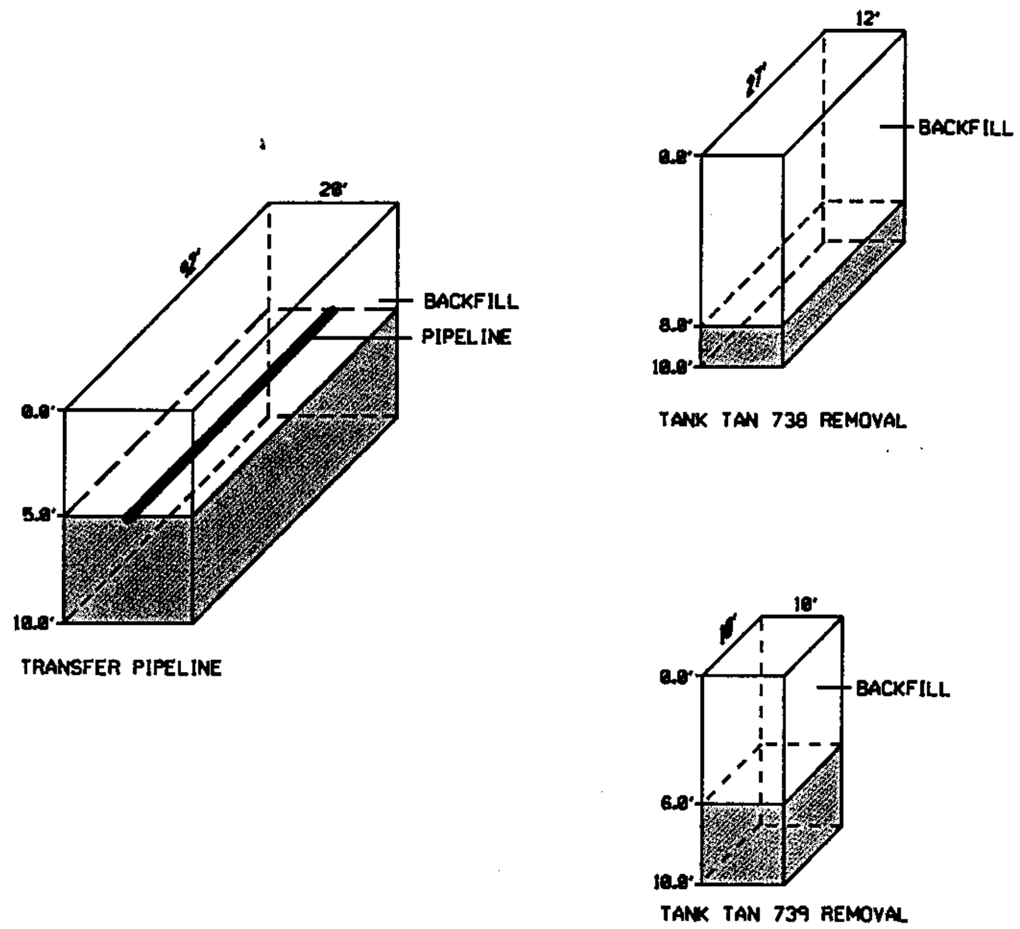


Figure 5-7. Location of WRRTF-13.



LEGEND

Zone of contamination

ASSUMPTIONS:

- The zone of contamination beneath the transfer pipeline extends to 3 m (10 ft) on either side of the pipeline, and from 1.5 m (5 ft) to 3 m (10 ft) bgs.
- The zone of contamination beneath the former location of tank TAN 738 extends from 2.4 m (8.0 ft) to 3 m (10 ft) bgs.
- The zone of contamination beneath the former location of tank TAN-1709 extends for 1.8 m (6 ft) to 3 m (10 ft) bgs.
- All contamination beneath the former location of tank TAN-787 is greater than 3 m (10 ft) bgs.
- Only contamination that is shallower than 3m (10 ft) bgs has to be removed.

Figure 5-8. WRRTF-13 volume assumption.

which allow air to flow easily through the vadose zone. The alluvial deposits in the TAN area are this type. Factors such as soil pH, moisture, and soil nutrients (i.e., nitrogen and phosphorus) would influence the effectiveness of the treatment. They would be monitored to determine whether changes such as the addition of nutrients would enhance the biodegradation process. Field testing of soil characteristics would be required to optimize the system.

Evaluation

Overall Protection of Human Health and the Environment. Alternative 5 would be effective in overall protection of human health and the environment. In situ natural degradation of contamination has minimal potential for human exposure compared to excavation, haulage, and ex situ treatment. This alternative would protect the air pathway also, since off-gassing of vapors would likely be minimal. Aside from drilling the wells and installing the blowers, surface disturbance would be minimal.

Compliance with ARARs. Through enhanced biodegradation, levels of total petroleum hydrocarbons would be reduced below State of Idaho cleanup levels. Monitoring of off-gases would allow compliance with emission-control ARARs. If ARAR emission levels were exceeded, a soil vapor extraction system would be installed, with carbon canisters added to the system as necessary.

Long-Term Effectiveness and Permanence. This alternative would be effective for long-term and permanent protection of human health and the environment through the reduction of subsurface contaminants to acceptable levels. The effectiveness of the technology in reducing contaminant concentrations could vary from site to site based on subsurface conditions. However, this is a standard and proven technology for the remediation of petroleum-contaminated soils.

Reduction of Toxicity, Mobility, or Volume through Treatment. The toxicity and volume of petroleum-related contaminants would be reduced by this alternative. Through biodegradation, contaminants would be broken down to form less-toxic compounds. The alternative also would result in a reduction of contaminant volume as the degradation process progresses. Mobility of the contaminants could be reduced through degradation .

Short-Term Effectiveness. Risks of exposure to workers or environmental receptors during the implementation of this alternative would be low. Short-term physical safety hazards could occur during the drilling and system installation activities. These, however, could be reduced through monitoring and enforcement of safe work practices. Exposure to site contaminants would be limited to possible contact with soil contaminants or soil vapors during drilling and system installation; these exposures could be minimized through proper use of PPEs.

Implementability. This technology uses standard drilling and construction equipment and personnel that are readily available in the INEEL area. This alternative would be relatively easy to implement compared to excavation, treatment, and disposal alternatives. Soil characterization would be required to ensure the effectiveness of the alternative. Permitting requirements would be minimal with this alternative.

Cost. The costs associated with Alternative 5 are shown in Appendix A and summarized in Table 5-5.

Table 5-5. Cost of Alternative 5 for WRRTF-13 fuel leak.

Alternative	Capital Costs (Net present value)	Operating Costs (Net present value)	Total Costs (Net present value)
Alternative 5	$1,857,335	$0	$1,857,335

6. COMPARATIVE ANALYSIS OF ALTERNATIVES FOR FS SUPPLEMENT SITES

The comparative analysis provides a measure of each alternative's relative performance against the CERCLA evaluation criteria. The purpose of this comparison is to identify the relative advantages and disadvantages of each alternative. The comparative analysis does not identify a preferred alternative, but provides sufficient information to allow selection of a preferred alternative by the Agencies.

This FS Supplement evaluates additional alternatives that may meet the RAOs established for OU 1-10 sites. In specific cases it also reevaluates a previous alternative based on new or revised information. Section 6 provides comparative analysis of the previously evaluated alternatives against the additional or reevaluated alternatives. This section includes comparative analysis information derived from the Comprehensive RI/FS. Tables have been prepared to compare how each alternative covered by this FS Supplement meets the CERCLA evaluation criteria and the RAOs. The tables show a relative ranking of the alternatives that can be used by the agency decision-makers in selecting a preferred alternative.

6.1 Comparative Analysis of Alternatives for the PM-2A Tanks

The alternatives evaluated in the Comprehensive RI/FS for the PM-2A tanks were:

- Alternative 1—No Action/Limited Action
- Alternative 2—Soil Excavation, Tank Removal, Treatment and Disposal
- Alternative 3—Soil Excavation, Tank Content Removal, Treatment and Disposal
- Alternative 4—Soil Excavation, In Situ Treatment of Tank Contents, and Soil Disposal
- Alternative 5—Soil Excavation, In Situ Vitrification of Tank Contents, and Soil Disposal

Due to concerns over the difficulty in achieving satisfactory waste treatment through in situ stabilization, the high cost for long-term monitoring, and evaluation of a new, available vacuum removal system for the waste, Alternative 3d was developed for this FS Supplement. Table 6-1 presents a summary of the comparative analysis conducted for the TSF-26 alternatives. Table 6-2 provides a relative ranking of the TSF-26 alternatives.

6.1.1 Overall Protection of Human Health and the Environment

Alternative 3 would be the most effective alternative in terms of overall protection, because it includes removal of contaminants; removal, proper characterization as required, and disposal of waste; and closure of the tanks. This would eliminate the need for long-term monitoring, maintenance, and control at the site. Alternatives 4 and 5 also would be protective. However, since the contaminants would be left in the tank in a stabilized or vitrified state, long-term monitoring and land use restrictions would be required to ensure that protectiveness is maintained. Both alternatives would require proper disposal of the contaminated soils at a land disposal facility to ensure long-term protection. The protectiveness of Alternative 3d would depend on the proper characterization and, if required, treatment of the tank wastes, and disposal of the wastes in a permitted hazardous waste landfill. Alternative 1 would not assure protection beyond the 100-year institutional period, and would involve costly long-term monitoring and maintenance. Alternative 2 would be protective by treating and disposing the waste at a managed facility.

6.1.2 Compliance with ARARs

Alternative 1 would not meet land disposal ARARs. Alternatives 2 and 3d would meet LDR ARARs through characterization and, as required, treatment. Most of the waste consists of diatomaceous earth; since recent analysis indicates low concentrations of radionuclides, metals and organics, it is anticipated that the waste would not require treatment prior to disposal at a RCRA-compliant facility (such as the proposed INEEL soil repository or Envirocare). Alternative 3d would meet air emission ARARs since the vacuum system is equipped with HEPA filtration. Alternative 5, in situ vitrification, would require off-gas treatment during the process and monitoring for compliance with Air Toxics Rules. The waste would have to be delisted for Alternatives 4 and 5 since F-listed waste would be disposed of in a non-RCRA compliant configuration.

6.1.3 Long-Term Effectiveness and Permanence

Alternatives 2 and 3d would provide long-term effectiveness and permanence. Since Alternatives 4 and 5 leave the contaminants at the site, long-term monitoring, maintenance, and administrative controls would be required following the stabilization or vitrification process. By removing site contaminants and disposing of the waste, Alternative 3d would provide a more permanent solution for the site. However, long-term effectiveness would require proper on-site or off-site disposal of the waste at a permitted disposal facility. Alternative 1 would provide little long-term effectiveness or permanence except through long-term access restrictions. Alternative 2 would provide long-term effectiveness and permanence for radionuclide- and metals-contaminated wastes but would not be effective for organic wastes.

6.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 2 and 4 would provide reduction in mobility of radionuclide and metals contaminants through stabilization. Alternative 3d would provide reduction of toxicity and volume through treatment, if it is determined through characterization required to meet disposal criteria. If treatment is not required there would be no reduction in toxicity or volume of contaminants, but mobility would be significantly reduced through disposal in a waste disposal facility. Alternative 5, the in situ vitrification process, would also result in some reduction in toxicity and volume through the destruction of organic contaminants. There would be no reduction in toxicity or volume for radionuclide and metals contamination, but mobility would be significantly reduced through vitrification.

6.1.5 Short-Term Effectiveness

There would be no short-term hazards associated with Alternative 1. Worker radiation exposure hazards would be present in all the remaining alternatives. Based on radiation monitoring, engineering controls such as lead shielding of equipment, use of high-energy particulate air (HEPA) filters, and other equipment modifications could be required. ALARA principles would be applied for worker exposure under each of the alternatives. Physical hazards also exist for Alternatives 2 through 5 common to excavation and construction activities. Adherence to health and safety procedures and use of proper PPE would minimize these potential hazards. Environmental impacts from all of the alternatives would be short-term and minimal. Overall, short-term effectiveness for Alternatives 2, 3d, and 5 would be considered moderate for potential worker exposures and safety hazards, and high for Alternative 4.

Table 6-1. Summary of comparative analysis of remedial alternatives for TSF-26 PM-2A tank contents and contaminated soils.

	Threshold Criteria		Primary Balancing Criteria				
Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost (Net present value)[a]
Alternative 1 Limited Action	Not protective, hence eliminated for comparison						
Alternative 2a Soil Excavation, Tank Removal, On-Site Treatment and Disposal	Protective of both human health and the environment	ARARs will be met through treatment and disposal.	Prevents human exposure to contaminants through proper treatment and disposal. Effectiveness depends on long-term management of the disposal facility	Toxicity would not be reduced. Mobility would be reduced. Volume would increase through stabilization.	Effective; controllable risk to workers, no risk to community or environment.	Moderately difficult to implement. Excavation and stabilization utilize standard locally available equipment. Administratively easy to implement.	$10,056,101
Alternative 2b Soil Excavation, Tank Removal, On-Site Treatment and Off Site Disposal	Protective of both human health and the environment	ARARs will be met through treatment and disposal.	Prevents human exposure to contaminants through proper treatment and disposal. Effectiveness depends on long-term management of the disposal facility	Toxicity would not be reduced. Mobility would be reduced. Volume would increase through stabilization.	Effective; controllable risk to workers, no risk to community or environment.	Moderately difficult to implement. Excavation and stabilization utilize standard locally available equipment. Administratively easy to implement.	$12,762,394
Alternative 3a Soil Excavation, Tank Contents Removal, On-Site Treatment, and On-Site Disposal	Protective of both human health and the environment	ARARs will be met through treatment and disposal.	Prevents human exposure to contaminants through proper treatment and disposal. Effectiveness depends on long-term management of the disposal facility	Toxicity would not be reduced. Mobility would be reduced. Volume would increase through stabilization.	Effective; controllable risk to workers, no risk to community or environment.	Moderately difficult to implement. Excavation and stabilization utilize standard locally available equipment. Administratively easy to implement.	$9,124,666
Alternative 3b Soil Excavation, Tank Contents Removal, On-Site Treatment, and Off-Site Disposal	Protective of both human health and the environment	ARARs will be met through treatment (if required) and disposal.	Prevents human exposure to contaminants through proper treatment and disposal. Effectiveness depends on long-term management of the disposal facility	Toxicity would not be reduced. Mobility would be reduced. Volume would increase through stabilization	Effective; controllable risk to workers, no risk to community or environment.	Moderately difficult to implement. Excavation, stabilization , and incineration utilize standard locally available equipment. Administratively easy to implement.	$12,074,943
Alternative 3d Soil Excavation, Tank Content Removal, On-Site Treatment (if required) and Disposal	Protective of both human health and the environment	Meets all identified ARARs/TBCs	Prevents human exposure to contaminants through proper characterization treatment and disposal. Effectiveness depends on long-term management of the disposal facility	Toxicity would be reduced if waste is thermally treated. Mobility would be reduced if waste is stabilized. Volume could be increased if waste required stabilization.	Effective; controllable risk to workers; no risk to community or environment	Easy to implement. Requires currently available equipment for tank content removal. Thermal treatment and stabilization would be easy to moderate to implement. Administratively easy to implement.	$6,269,801

Table 6-1. (continued).

	Threshold Criteria		Primary Balancing Criteria				
Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost (Net present value)[a]
Alternative 4a Soil Excavation In Situ Treatment of Tank Contents and On Site Disposal-	Protective of both human health and the environment	Meets identified ARARs/TBCs, but delisting requirements would have to be met.	Effective and permanent in preventing human exposure and further environmental impact. Long-term monitoring and land use restrictions would be required.	Treatment reduces mobility but increases volume. Toxicity is not reduced.	Effective; controllable risk to workers, environment, and community	Moderately difficult to implement. Requires specialized equipment for in situ treatment of tank wastes. Excavation utilizes locally available equipment. Administratively easy to implement.	$6,100,749
Alternative 4b Soil Excavation In Situ Treatment of Tank Contents and Off Site Disposal-	Protective of both human health and the environment	Meets identified ARARs/TBCs, but delisting requirements would have to be met.	Effective and permanent in preventing human exposure and further environmental impact. Long-term monitoring and land use restrictions would be required.	Treatment reduces mobility but increases volume. Toxicity is not reduced.	Effective; controllable risk to workers, environment, and community	Moderately difficult to implement. Requires specialized equipment for in situ treatment of tank wastes. Excavation utilizes locally available equipment. Administratively easy to implement.	$8,833,063
Alternative 5a Soil Excavation, In Situ Vitrification of Tank Contents and On Site Disposal	Protective of both human health and the environment	Meets ARARs/TBCs, and delisting requirements. .	Effective and permanent in preventing human exposure Long-term monitoring and land use restrictions would be required.	Organic contaminants would be destroyed. Metals and radionuclides would till retain toxicity but mobility would be reduced.	Effective; controllable risk to workers; environment; and community	Innovative technology not demonstrated at INEEL. Vendors are available but requires specialized equipment and trained personnel	$13,574,740
Alternative 5b Soil Excavation, In Situ Vitrification of Tank Contents and Off Site Disposal	Protective of both human health and the environment	Meets ARARs/TBCs, and delisting requirements	Effective and permanent in preventing human exposure Long-term monitoring and land use restrictions would be required.	Organic contaminants would be destroyed. Metals and radionuclides would till retain toxicity but mobility would be reduced	Effective; controllable risk to workers; environment; and community	Innovative technology not demonstrated at INEEL. Vendors are available but requires specialized equipment and trained personnel	$16,281,032

a. FY-98 costs include 30% contingency.

Table 6-2. Relative ranking[a] of alternatives for TSF-26 PM-2A tank contents and contaminated soils

	Threshold Criteria		Primary Balancing Criteria				
Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost (Net present value)
Alternative 1 Limited Action	Does not meet criteria	Does not meet criteria					
Alternative 2a Soil Excavation, Tank Removal, On-Site Treatment and On Site Disposal	Meets Criteria	Meets Criteria	High	Moderate	Moderate	Moderate	$10,056,101
Alternative 2b Soil Excavation, Tank Removal, On-Site Treatment and Off Site Disposal	Meets Criteria	Meets Criteria	High	Moderate	Moderate	Moderate	$12,762,394
Alternative 3a Soil Excavation, Tank Content Removal, On Site Treatment and On Site Disposal	Meets Criteria	Meets Criteria	High	Moderate	Moderate	Moderate	$9,124,666
Alternative 3b Soil Excavation, Tank Content Removal, On Site Treatment and Off Site Disposal	Meets Criteria	Meets Criteria	High	Moderate	Moderate	Moderate	$12,074,943
Alternative 3d Soil Excavation, Tank Content Removal, On-Site Treatment and Disposal	Meets criteria	Meets criteria	High	Moderate	Moderate	High	$6,269,801

Table 6-2. (continued).

Alternative	Threshold Criteria: Overall Protection of Human Health and the Environment	Threshold Criteria: Compliance with ARARs	Primary Balancing Criteria: Long-Term Effectiveness and Permanence	Primary Balancing Criteria: Reduction of Toxicity, Mobility, or Volume through Treatment	Primary Balancing Criteria: Short-Term Effectiveness	Primary Balancing Criteria: Implementability	Primary Balancing Criteria: Cost (Net present value)
Alternative 4a Soil Excavation, In Situ Treatment of Tank Contents, and On Site Disposal	Meets criteria	Meets criteria	Moderate	Moderate	High	Low	$6,100,749
Alternative 4b Soil Excavation, In Situ Treatment of Tank Contents, and Off Site Disposal	Meets criteria	Meets criteria	Moderate	Moderate	High	Low	$8,833,063
Alternative 5a Soil Excavation, In Situ Vitrification, and On Site Disposal	Meets criteria	Meets Criteria	Moderate	High	Moderate	Low	$13,574,740
Alternative 5b Soil Excavation, In Situ Vitrification, and Disposal	Meets criteria	Meets Criteria	Moderate	High	Moderate	Low	$16,281,032

a. The relative ranking scheme presented in this table represents a subjective ranking of the alternatives against one another. A ranking of "high" indicates that an alternative best satisfies the evaluation criterion. A ranking of "low" indicates that the alternative least satisfies the evaluation criterion.

6.1.6 Implementability

Alternative 1 would be easily implemented but would require long-term maintenance and enforcement of institutional controls for 100 years. Alternatives 2 and 3d would be technically feasible and utilize standard equipment. Removal of the tank contents and on-site treatment activities would be easy to moderately difficult to implement. Alternatives 4 and 5 would be more difficult to implement because of technical difficulties in achieving in situ stabilization of waste in a solid phase and the additional development effort required to demonstrate in situ vitrification on a buried tank as large as the PM-2A tank.

6.1.7 Costs

The costs associated with Alternative 3d include excavation of radionuclide-contaminated soils, removal of tank contents, decontamination of tanks in-place followed by filling with inert material, treatment of contents, and transportation of the excavated soils and treated materials to the proposed INEEL soil repository. The total estimated cost is shown on Table 6-1. The alternative net present value cost estimates are for comparison purposes only and not intended for budgetary, planning, or funding purposes.

6.2 Comparative Analysis of Alternatives for the TSF-03 and WRRTF-01 Burn Pits

The Comprehensive RI/FS evaluated the following alternatives:

- Alternative 1—No Action/Limited Action
- Alternative 2—Native Soil Cover
- Alternative 3—Excavation and Disposal
- Alternative 4—Excavation and Soil Washing On-Site.

This FS Supplement has added the following alternative:

- Alternative 3b—Excavation and On-Site Disposal.

6.2.1 Overall Protection of Human Health and the Environment

The comparative analysis for this criterion measures an alternative's ability to achieve the RAOs for OU 1-10 that were specifically developed to be protective of human health and the environment. Table 6-3 provides a summary of the comparative analysis for the alternatives evaluated for the burn pits. Table 6-4 provides a relative ranking of the alternatives.

Alternative 3b proposes additional sampling and analysis of the burn pits to better characterize the contamination at these sites. Results may show that other contaminants besides lead exist at levels that pose unacceptable risk. Current analytical data and risk estimates indicate that Alternative 1 will meet the RAOs only for the 100-year period of institutional control and would require long-term monitoring and maintenance and administrative controls (i.e., land use restrictions) to ensure that RAOs would continue to be met in the future. The alternative may not ensure long-term protection after the 100-year period of institutional control. This is because lead is highly persistent and will remain at levels that would pose a threat if institutional controls were not enforced forever. Limited action will not prevent intrusion into the

Table 6-3. Summary of comparative analysis of remedial alternatives for TSF-03 and WRRTF-01 burn sites.

	Threshold Criteria		Primary Balancing Criteria				
Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost (Net present value)[a]
Alternative 1 Limited Action	Protective of both human health and the environment at least through the period of institutional control. Since maintenance of the existing soil is not assumed, there is a potential for biointrusion..	Meets all ARARs/TBCs at least through the period of institutional controls.	Does not reduce residual risk or long-term environmental impacts	None through treatment	Highly effective; no short-term risks to workers or the community	Immediately implemented	$2,894,502
Alternative 2 Native Soil Cover	Protective of both human health and the environment	Meets all ARARs/TBCs	Prevents human exposure to contaminants, but does not permanently prevent biointrusion.	None through treatment	Effective; controllable short-term risks to workers or the community	Reliable technology; administratively easy to implement. Requires long-term maintenance an administrative controls	$5,971,335
Alternative 3a Excavation and Off-Site Disposal	Protective of both human health and the environment	Meets all identified ARARs/TBCs	Prevents human and ecological exposure to contaminants. Effectiveness is dependent on long-term management of the off-site disposal facility	None through treatment	Effective; controllable risk to workers; no risk to community or environment	Reliable technology; easy to implement	$13,870,685
Alternative 3b Waste Characterization, Excavation and Disposal at the proposed INEEL repository or other approved on-site facility	Protective of both human health and the environment	Meets identified ARARs/TBCs	Effective and permanent in preventing human and ecological exposure and further environmental impact	Treatment Options evaluated based on characterization sampling. Treatment to be performed as appropriate to meet disposal requirements, which could reduce toxicity, mobility, or volume.	Effective; controllable risk to workers, environment, and community (during off-site transport)	Reliable technologies for excavation and treatment if required; easy to implement	$6,021,049
Alternative 4b Excavation and Soil Washing	Protective of both human health and the environment	Meets identified ARARs/TBCs	Effective and permanent in preventing human and ecological exposure and further environmental impact	Treatment for lead reduces contaminant volume.	Effective; controllable risk to workers, environment, and community	Reliable technologies for excavation. Soil washing technology is readily available but moderately difficult to implement	$18,263,126

a. FY-98 costs include 30% % contingency.

Table 6-4. Relative ranking[a] of alternatives for TSF-03 and WRRTF-01 burn sites.

	Threshold Criteria		Primary Balancing Criteria				
Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost (FY-98 Dollars)
Alternative 1 Limited Action	Meets criteria	Meets criteria	Low	Low	High	High	$2,894,502
Alternative 2 Native Soil Cover	Meets criteria	Meets criteria	Moderate	Low	Moderate	High	$5,971,335
Alternative 3a Excavation and Off-Site Disposal	Meets criteria	Meets criteria	High	Low	Moderate	High	$13,870,685
Alternative 3b Waste Characterization, Excavation, and Disposal at the proposed INEEL soil repository or other approved on-site facility	Meets criteria	Meets criteria	High	Moderate	Moderate	High	$6,021,049
Alternative 4b Excavation and Soil Washing	Meets criteria	Meets criteria	High	Moderate	Moderate	Moderate	$18,263,126

a. The relative ranking scheme presented in this table represents a subjective ranking of the alternatives against one another. A ranking value of "high" indicates that an alternative best satisfies the evaluation criterion. A ranking of "low" indicates that the alternative least satisfies the evaluation criterion.

contaminated soils by burrowing animals, or potential uptake of contaminants by plants and subsequent ingestion of contaminated plants by animals. In addition, wind erosion could breach the soil cover, which in some places is less than 6 inches, resulting in potential contaminant migration and exposure through fugitive dust as well as transport of contaminants off-site via the surface water pathway from precipitation.

Alternatives 3a and 3b would provide good overall protection of human health and the environment as long as proper off-site disposal at a permitted and well-maintained disposal facility is ensured. Alternatives 3b and 4b would provide the best overall protection by using effective treatment and proper disposal of treatment wastes at a permitted disposal facility. However, Alternative 4b is designed to remove only the lead contaminants. If other contaminants, such as organics, were found at concentrations exceeding PRGs, the excavated soil and debris may not meet criteria for disposal unless additional treatment was performed. Institutional controls would no longer be required following completion of Alternative 4b. Under Alternative 3b, removal of the site contaminants followed by treatment and proper disposal at the INEEL soil repository would provide a permanent solution, and long-term institutional controls would no longer be required. Permanence would depend on the proper disposal of treatment wastes in a permitted disposal facility.

6.2.2 Compliance with ARARs

Current site information suggests all alternatives would meet the potential ARARs or TBCs . Under Alternative 1, maintenance of the soil cover is not assured, hence there is a potential for biointrusion. Long-term maintenance of the soil cover would be required under Alternative 2 to ensure compliance with air emissions and surface-water runoff ARARs. Based on the results of additional sampling at these sites, compliance with ARARs would have to be reevaluated prior to alternative implementation.

6.2.3 Long-Term Effectiveness and Permanence

Alternatives 3a, 3b, and 4b would all provide good long-term effectiveness and permanence. The effectiveness of Alternative 2 would rely on long-term monitoring, soil cover maintenance, surface-water runoff control, and administrative controls. Alternatives 1 may not provide a permanent solution for lead-contaminated soils due to the long-term persistence of lead, which will remain at unacceptable levels after the 100 years institutional control period.

6.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Because Alternatives 1 and 2 would not involve treatment, they would not meet this evaluation criterion. There would be no reduction in toxicity, mobility, or volume except through the effects of natural attenuation processes over time. Alternatives 3a does not include treatment, and toxicity and volume would not be reduced. Disposal in a properly managed and permitted off-site disposal facility would result in a reduction in mobility. Alternative 4b involves the extraction of lead contaminants through physical separation and acid leaching. However, no reduction in toxicity would take place and other contaminants would not be eliminated using this treatment. Recovery and recycling or disposal of the lead would result in a reduction of mobility. Alternative 3b would include additional treatment of hazardous waste as required to meet land disposal restrictions (LDRs). If treatment for organics were required, reduction of toxicity, mobility, and volume would result. For metals, no reduction in toxicity or volume would occur, but mobility would be reduced through recycling or disposal.

6.2.5 Short-Term Effectiveness

No short-term potential human or environmental health risks are associated with Alternative 1. For Alternative 2, worker exposure during construction of the soil cap is possible due to subsidence in the pits. Nonexposure risks result from physical construction hazards. These risks can be minimized by use of proper personal protective equipment, engineering controls, and implementation of health and safety measures. For Alternatives 3a, 3b, and 4b, potential worker contaminant exposure and physical safety hazards associated with the excavation and haulage activities would be minimized though administrative and engineering controls. Due to the short duration of the excavation and disposal activities for Alternatives 3a, 3b, and 4b, impacts to surrounding workers or ecological receptors would be minimal. Following excavation activities the land surface would be restored to pre-excavation conditions, so there would be no long-term impacts to the environment. None of the alternatives evaluated are expected to provide significant short-term risks or hazards.

6.2.6 Implementability

Alternative 1 would be easy to implement. Engineering and administrative activities would be conducted utilizing on-site or local contractor personnel and equipment. Implementation procedures established at other INEEL sites would be utilized for implementing Alternative 1.

Alternative 2, native soil cover, also would be easy to implement using standard construction equipment and personnel readily available in the INEEL area. This alternative has also been applied at other INEEL sites and is a technically viable alternative. Cover materials are available either within the INEEL or from a local source. Long-term monitoring of the cover would be required, but administrative procedures for this type of monitoring already are in place at other INEEL sites.

Alternatives 3a and 3b involve the use of standard excavation and transportation equipment and personnel. Implementation would require use of standard personnel health and safety procedures. Potential exposure to workers would be minimized through standard engineering controls (i.e., dust suppression). Soil used for backfilling and grading following excavation would be obtained within the INEEL or from a local source. Implementability of the off-site disposal alternatives would be high since equipment and procedures for transportation are available.

Alternative 4b would be the most difficult to implement due to the addition of treatment options. Soil washing is technically feasible but moderately difficult to implement. Treatability studies would be required prior to implementation to ensure that soil washing effectively removes lead contamination from site soils. This technology has not been demonstrated as feasible at the INEEL. Excavation and soil washing equipment, however, are readily available. Recovered lead waste would have to be recycled or disposed of as hazardous waste. Off-site disposal facilities accepting lead waste are limited and likely to be located a great distance from INEEL, making the implementation of this alternative more difficult.

6.2.7 Costs

The costs of Alternative 3b include additional characterization, conventional excavation and transportation of soils and debris to an on-site disposal facility, backfilling of excavated areas with clean INEEL soils (or treated soils if cost-effective), and grading and revegetating the site to natural conditions. As consistent with the off-site disposal option described in the Comprehensive RI/FS, it was assumed no treatment would be required for disposal in a RCRA-compliant landfill; hence, no costs for treatment were included in the estimate. The cost analysis for this alternative assumes that no post-closure monitoring or care is required. The alternative cost estimates are for comparison purposes only and not intended for budgetary, planning, or funding purposes. The estimated net present value of this alternative for TSF-03 and WRRTF-01 is summarized in Table 6-3.

6.3 Comparative Analysis of Alternatives for WRRTF-13 Fuel Leak

Alternatives evaluated for the WRRTF-13 contaminated soils include:

- Alternative 1—No Action/Limited Action
- Alternative 4—Excavation and Land Farming
- Alternative 5—In Situ Biodegradation using Bioventing.

Alternative 5 was developed for this FS Supplement in response to a concern that bioremediation remedies were not evaluated in the Comprehensive RI/FS. Table 6-5 presents a summary of the comparative analysis for the WRRTF-13 alternatives. Table 6-6 provides a relative ranking of the alternatives.

6.3.1 Overall Protection of Human Health and the Environment

Alternative 1 would provide the least amount of overall protection to human health since contaminants would be left in place and subsurface contaminant migration would be possible. There would be no current risks to human health or the environment under this alternative. Long-term protection would be contingent on long-term monitoring, maintenance, and administrative controls. Alternative 4 would provide good overall protection through removal and ex situ treatment of petroleum-contaminated soils. There would be some risk of exposure during implementation of the alternative since the contaminants would be excavated and treated at the ground surface. Alternative 5 would provide the greatest protection through enhanced natural in situ biodegradation of contaminants. The implementation of this alternative would provide little short-term exposure risk and would eliminate the need for long-term monitoring or institutional controls.

6.3.2 Compliance with ARARs

All three alternatives would comply with ARARs. Land farming would require engineering controls to meet air emissions ARARs. Alternative 4 would require surface air monitoring to ensure that excessive volatilization to the surface does not occur.

6.3.3 Long-Term Effectiveness and Permanence

Alternative 1 would require long-term monitoring and administrative controls to ensure long-term effectiveness. Alternatives 4 and 5 would provide both long-term effectiveness and permanence through the destruction of contaminants and conversion to less toxic compounds.

6.3.4 Reduction of Toxicity, Mobility, or Volume though Treatment

Alternative 1 would not involve treatment. Reduction of contaminant toxicity and volume would be reduced over time through natural attenuation processes. Mobility would not be reduced through this alternative. Alternatives 4 and 5 would result in the reduction of toxicity and volume through enhanced natural processes. Mobility of contaminants could be reduced through degradation.

Table 6-5. Summary of comparative analysis of remedial alternatives for WRRTF-13 Fuel Leak.

	Threshold Criteria		Primary Balancing Criteria				
Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost (Net present value)[a]
Alternative 1 Limited Action	Long-term institutional controls required to ensure protection of human health and the environment.	Meets identified ARARs/TBCs	Does not reduce residual risk or long-term environmental impacts	None through treatment. Reduction by natural attenuation will occur over time.	Highly effective; no short-term risks to workers or the community	Immediately implemented	$1,399,757
Alternative 4 Excavation and Land Farming	Protective of both human health and the environment	Meets identified ARARs/TBCs	Effective and permanent in preventing human exposure and further environmental impact	Reduces contaminant toxicity, volume and mobility.	Effective; controllable risk to workers, environment, and community	Reliable technologies for excavation. Soil land farming equipment is readily available locally. Fairly easy to implement	$829,055
Alternative 5 In Situ Biodegradation	Protective of both human health and the environment	Meets identified ARARs/TBCs	Effective and permanent in preventing human exposure and further environmental impact	Reduces contaminant toxicity and volume.	Effective; controllable risk to workers and environment. No risk to community	Bioventing technology is readily available and only moderately difficult to implement May require 1-2 years of operation	$1,857,335

a. FY-98 costs include 30% contingency.

Table 6-6. Relative ranking[a] of alternatives for WRRTF-13 Fuel Leak.

	Threshold Criteria		Primary Balancing Criteria				
Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost (Net present value)
Alternative 1 Limited Action	Meets criteria at least for the period of institutional control.	Meets criteria	Low	Low	High	High	$1,399,757
Alternative 4c Excavation and Land Farming	Meets criteria	Meets criteria	High	High	Moderate	Moderate	$829,055
Alternative 5 In Situ Biodegradation	Meets criteria	Meets criteria	High	High	Moderate	High	$1,857,335

a. The relative ranking scheme presented in this table represents a subjective ranking of the alternatives against one another. A ranking of "high" indicates that an alternative best satisfies the evaluation criterion. A ranking of "low" indicates that the alternative least satisfies the evaluation criterion.

6.3.5 Short-Term Effectiveness

There would be no short-term hazards or risks associated with Alternative 1. Alternative 4, through excavation and land farming, would result in short-term exposure risks and temporary disturbance of surface habitat. There also would be common safety hazards associated with excavation and farming equipment that could be controlled by implementation and adherence to health and safety procedures. Alternative 5 would involve the use of drilling equipment to install shallow wells. There would be short-term safety risks associated with the drilling equipment that could be minimized by adherence to health and safety procedures.

6.3.6 Implementability

Alternative 4 would be moderately difficult to implement since a significant portion of the contaminated soils are inaccessible and could not be removed without disturbing existing utilities and roads. This alternative would utilize standard excavation and farming equipment that would be readily available from local vendors. Alternative 1 would be easily implementable. Alternative 5 also would be easily implemented using proven and available equipment and could treat all the contaminated soil without disturbing existing utilities and roads.

6.3.7 Costs

The cost of this alternative includes installation of a network of injection wells and blowers to induce in situ bioventing. Sampling and analysis would be required during operation. At the conclusion, it is assumed no post-closure monitoring or care is required. The alternative cost estimates are for comparison purposes only and not intended for budgetary, planning, or funding purposes. The estimated net present value of the alternative for WRRTF-13 is summarized in Table 6-5.

7. REFERENCES

Lockheed Martin Idaho Technologies Company (LMITCO*), Comprehensive Remedial Investigation/Feasibility Study for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory*, November 1, 1997, DOE/ID-10557.

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U.S. Department of Energy, Idaho Operations Office, U.S. Environmental Protection Agency, and State of Idaho Department of Health and Welfare, *Proposed Plan for Waste Area Group 1—Test Area North, Idaho National Engineering and Environmental Laboratory*, February 1, 1998 (DOE/ID-10443).